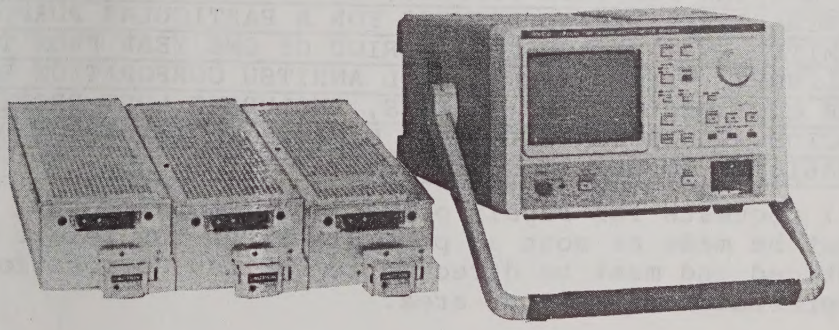
Anritsu

SERVICE MANUAL

PLUG-IN UNIT FOR MW920A

MH951A, MH952A
MH958A, MH968A



Applicable Serial Nos.
start from M29184
1991.07 Ver. III
Printed in Japan
1992.03 x 70 N-6(Y)

CERTIFICATION

ANRITSU CORPORATION certifies that this instrument has been thoroughly tested and inspected, and found to meet published specifications prior to shipping.
Anritsu further certifies that its calibration measurements are based on the Japanese Electrotechnical Laboratory and Radio Research Laboratory standards.

WARRANTY

All parts of this product are warranted by Anritsu Corporation of Japan against defects in material or workmanship for a period of one year from the date of delivery. In the event of a defect occurring during the warranty period, Anritsu Corporation will repair or replace this product within a reasonable period of time after notification, free-of-charge, provided that: it is returned to Anritsu; has not been misused; has not been damaged by an act of God; and that the user has followed the instructions in the operation manual.

Any unauthorized modification, repair, or attempt to repair, will render this warranty void.

This warranty is effective only for the original purchaser of this product and is not transferable if it is resold.

ALL OTHER EXPRESSED WARRANTIES ARE DISCLAIMED AND ALL IMPLIED WARRANTIES FOR THIS PRODUCT, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO A PERIOD OF ONE YEAR FROM THE DATE OF DELIVERY. IN NO EVENT SHALL ANRITSU CORPORATION BE LIABLE TO THE CUSTOMER FOR ANY DAMAGES, INCLUDING LOST PROFITS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, ARISING OUT OF THE USE OR INABILITY TO USE THIS PRODUCT.

All requests for repair or replacement under this warranty must be made as soon as possible after the defect has been noticed and must be directed to Anritsu Corporation or its representative in your area.

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WARNING

NO OPERATOR SERVICEABLE PARTS INSIDE.
REFER SERVICING TO QUALIFIED PERSONNEL.

CAUTION

FOR CONTINUED FIRE PROTECTION REPLACE
ONLY WITH SPECIFIED TYPE AND RATED FUSE.

Note:

WARNINGs, CAUTIONs, Notes, and Explanatory footnotes are used in this manual. Their meanings are given below:

WARNING: WARNING is used when there is a personal injury hazard.

CAUTION: CAUTION is used when the equipment may be damaged.

Note: Note is used to provide information about exceptions, corrections, and restrictions.

Explanatory footnote:

Explanatory footnotes provide comments on the same page as the text, figure or table. They are referenced by either an asterisk (*) or by combination of an asterisk and numeral.

HISTORY OF MODIFICATIONS
(MH951A.952A.958A.968A Ser.)

MAR.5 '92

ITEM	DESCRIPTION		Applicable Serial NO.
	Before Modification	After Modification	
P.5-17	Parts List: CONT & APD (A5. MH951A)(W4W12080 4/5)		
	R28.R29 CF.(ARD25T104J) 100kΩ.±5%.1/4W	R28.R29 CF.(ARD25T473J) 47kΩ.±5%.1/4W	
P.3-99/ 3-100	CONT & APD(A5.MH951A)Circuit Diagram (W3W4643 3/4 M-1)		
	R28.R29 100k	R28.R29 47k	
P.5-18	Parts List: CONT & APD(A5. MH952A)(W4W12082 4/5)		
	R28.R29 CF.(ARD25T104J) 100kΩ.±5%.1/4W	R28.R29 CF.(ARD25T473J) 47kΩ.±5%.1/4W	
P.3-107/ 3-108	CONT & APD(A5.MH952A)Circuit Diagram (W3W4644 3/4 M-1)		
	R28.R29 100k	R28.R29 47k	
P.5-20	Parts List: CONT & APD (A5. MH958A/MH968A) (W4W12089 4/5)		
	R28.R29 CF.(ARD25T104J) 100kΩ.±5%.1/4W	R28.R29 CF.(ARD25T473J) 47kΩ.±5%.1/4W	
P.3-115/ 3-116	CONT & APD (A5.MH958A/MH968A) Circuit Diagram (W3W4645 3/4 M-1)		
	R28.R29 100k	R28.R29 47k	From MT31190

HISTORY OF MODIFICATIONS
(MH951A,MH952A,MH958A,MH968A Ser.)

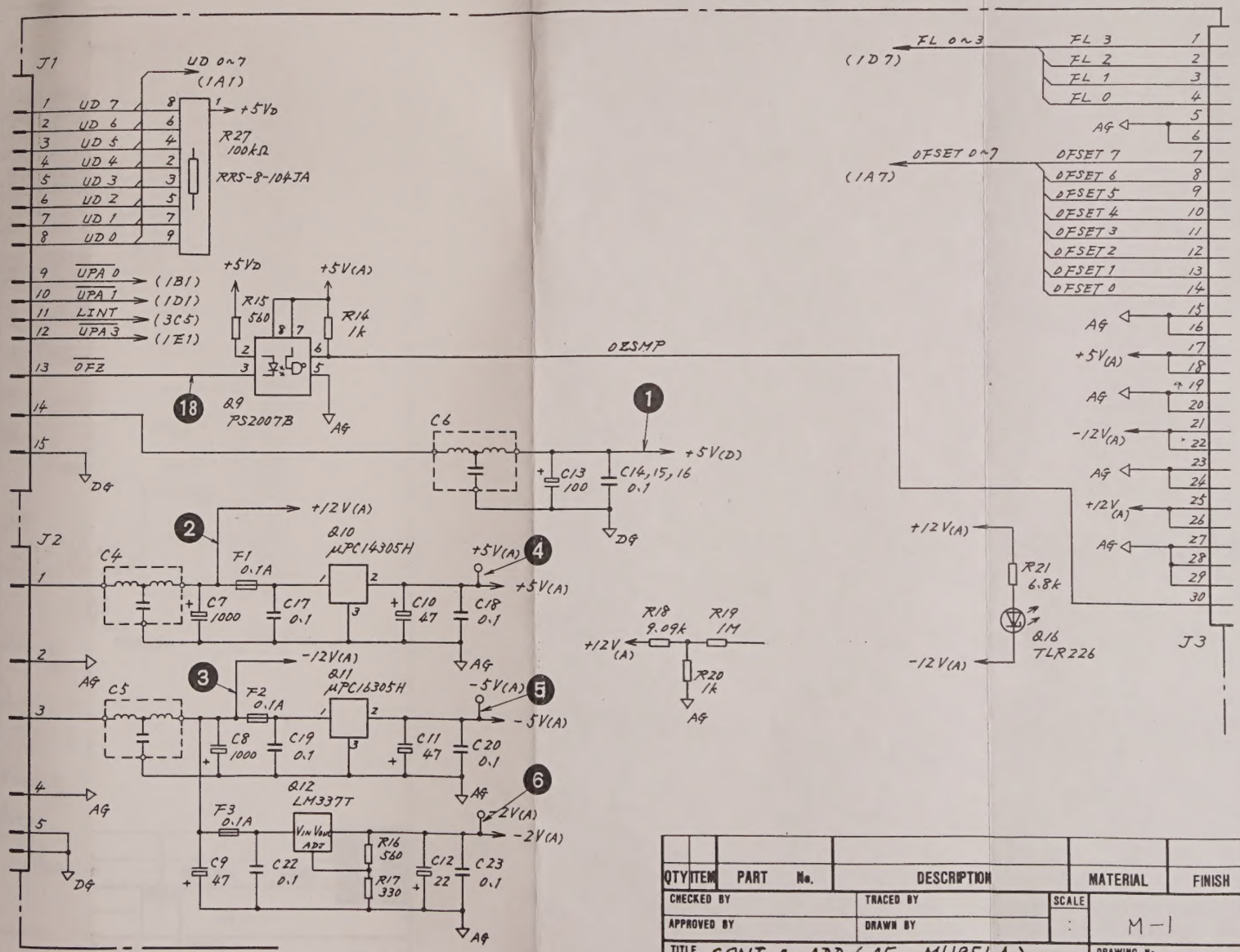
MAR.5 '92

ITEM	DESCRIPTION		Applicable Serial NO.
	Before Modification	After Modification	
P.5-17	Parts List: CONT & APD (A5,MH951A) (W4W12080 3/5, M-2)		
	M1 TIMER,(TM-0) 5000H	M1 Not assigned	
P.3-97/ 3-98	CONT & APD (A5,MH951A) Circuit Diagram		
	W3W4643 2/4	W3W4643 2/4 M-1	
P.5-18	Parts List: CONT & APD (A5,MH952A) (W4W12082 3/5 M-2)		
	M1 TIMER,(TM-0) 5000H	MI Not assigned	
P.3-105/ 3-106	CONT & APD (A5,MH952A) Circuit Diagram		
	W3W4644 2/4	W3W4644 2/4 M-1	
P.5-19	Parts List: CONT & APD (A5,MH958A/968A) (W4W12089 3/5 M-2)		
	M1 TIMER,(TM-0) 5000H	M1 Not assigned	
P.3-113/ 3-114	CONT & APD (A5,MH958A/968A) Circuit Diagram		
	W3W4645 2/4	W3W4645 2/4 M-1	From MT31190

W3 W 4643 2/4

APPLICATION

REVISIONS



QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

CHECKED BY | TRACED BY | SCALE : M-1

APPROVED BY | DRAWN BY

TITLE CONT & APD (A5, MH951A) Circuit Diagram

DRAWING No. W3 W 4643 2/4

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DEP

No. 0023-1985.08

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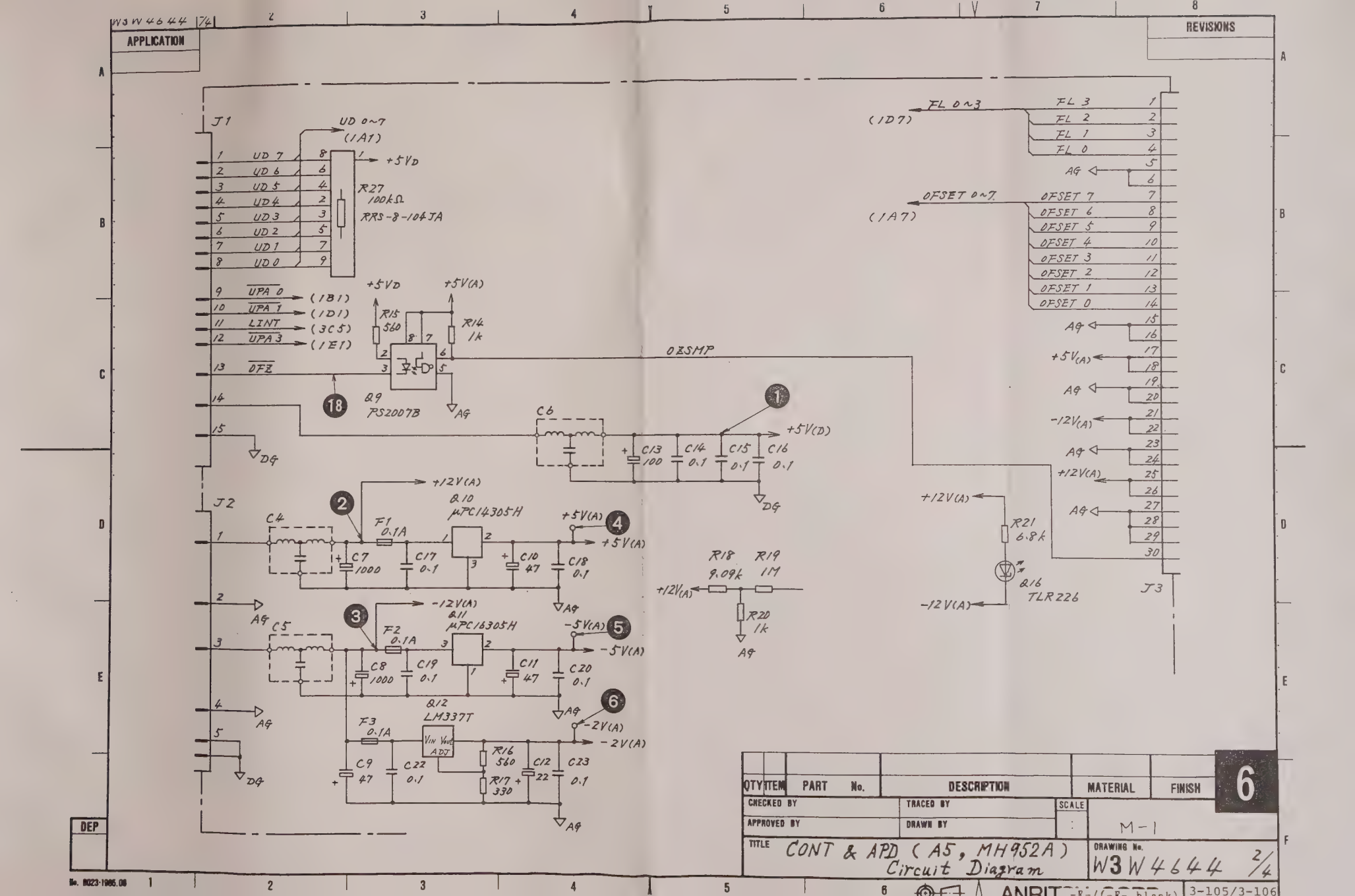
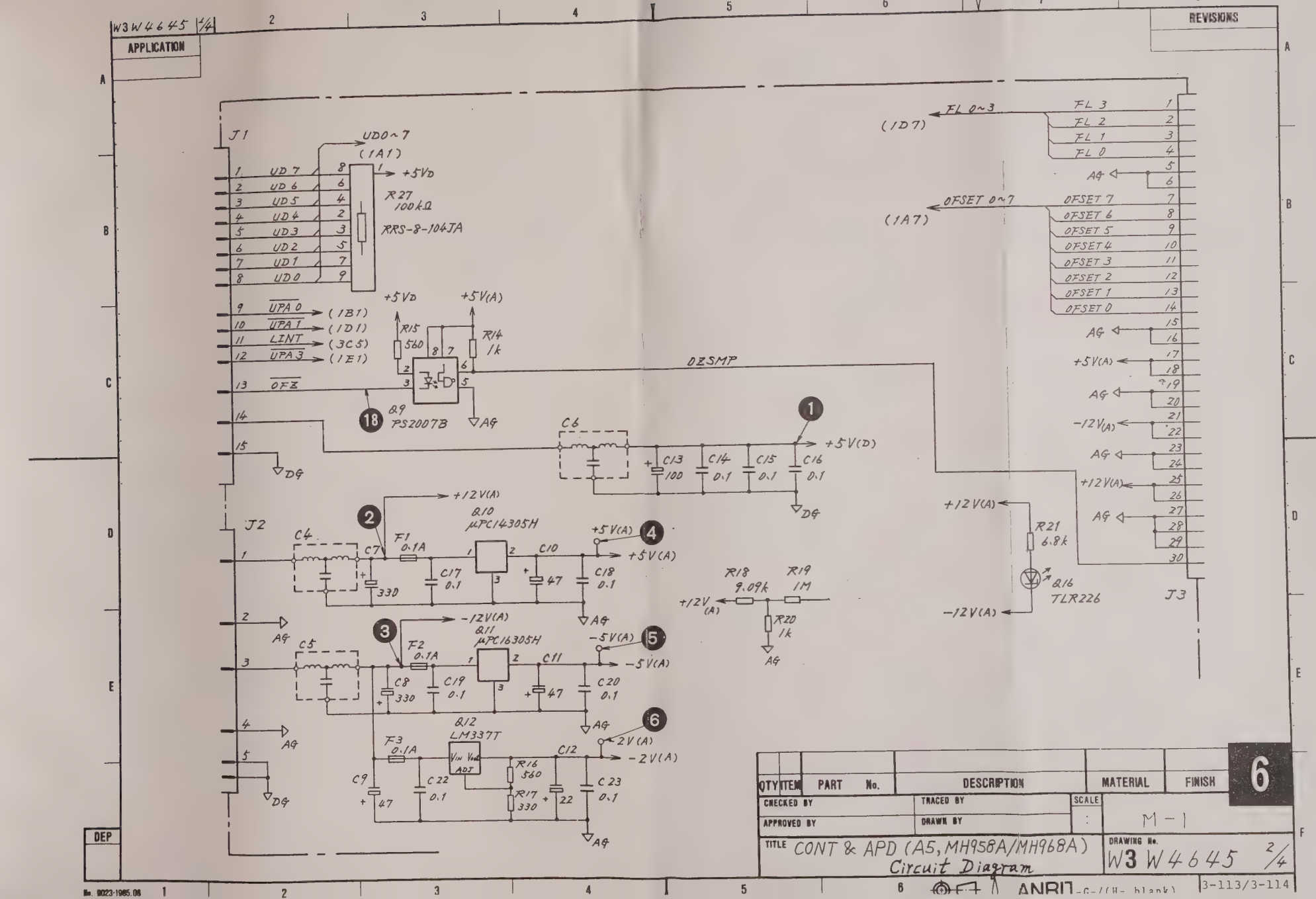

W3W4644 2/4
APPLICATION
REVISIONS
J1
UD 0~7
(1A1)
UD 7
UD 6
UD 5
UD 4
UD 3
UD 2
UD 1
UD 0
+5VD
R27
100kΩ
RRS-8-104JA
UPA 0
UPA 1
LINT
UPA 3
OFE
(1B1)
(1D1)
(3C5)
(1E1)
R15
560
R14
1k
Q9
RS2007B
OESMP
DG
AG
C6
C13
100
C14
0.1
C15
0.1
C16
0.1
+5V(D)
J2
C4
C7
1000
F1
0.1A
Q10
μPC14305H
+12V(A)
C17
0.1
C10
47
C18
0.1
+5V(A)
C5
C8
1000
F2
0.1A
Q11
μPC16305H
-12V(A)
C19
0.1
C11
47
C20
0.1
-5V(A)
Q12
LM337T
F3
0.1A
VIN VOUT ADJ
C9
47
C22
0.1
R16
560
R17
330
C12
22
C23
0.1
-2V(A)
R18
9.09k
R19
1M
R20
1k
R21
6.8k
Q16
TLR226
FL 0~3
(1D7)
FL 3
FL 2
FL 1
FL 0
OFSET 0~7
(1A7)
OFSET 7
OFSET 6
OFSET 5
OFSET 4
OFSET 3
OFSET 2
OFSET 1
OFSET 0
J3
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY
APPROVED BY
TRACED BY
DRAWN BY
SCALE
M-1
TITLE CONT & APD (A5, MH952A) Circuit Diagram
DRAWING No. W3W4644 2/4
DEP
No. 8023-1985.08
ANRITSU
3-105/3-106


W3 W4645 2/4
APPLICATION
REVISIONS
J1
UD0~7
(1A1)
UD 7
UD 6
UD 5
UD 4
UD 3
UD 2
UD 1
UD 0
+5VD
R27
100kΩ
RRS-8-104JA
UPA 0
UPA 1
LINT
UPA 3
OFE
(1B1)
(1D1)
(3C5)
(1E1)
+5VD
+5V(A)
R15
560
R14
1k
18
Q9
PS2007B
AG
DG
DESMP
C6
C13
100
C14
0.1
C15
0.1
C16
0.1
1
+5V(D)
J2
C4
C7
330
F1
0.1A
+12V(A)
Q10
μPC14305H
2
C17
0.1
C10
47
C18
0.1
+5V(A)
4
+5V(A)
C5
C8
330
F2
0.1A
-12V(A)
Q11
μPC16305H
3
C19
0.1
C11
47
C20
0.1
-5V(A)
5
-5V(A)
C9
47
F3
0.1A
Q12
LM337T
Vin Vout
ADJ
6
-2V(A)
C22
0.1
R16
560
R17
330
C12
22
C23
0.1
R18
9.09k
R19
1M
R20
1k
+12V(A)
FL 0~3
(1D7)
FL 3
FL 2
FL 1
FL 0
OFSET 0~7
(1A7)
OFSET 7
OFSET 6
OFSET 5
OFSET 4
OFSET 3
OFSET 2
OFSET 1
OFSET 0
R21
6.8k
Q16
TLR226
J3
DEP
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY
TRACED BY
SCALE
APPROVED BY
DRAWN BY
M-1
TITLE CONT & APD (A5, MH958A/MH968A)
Circuit Diagram
DRAWING No. W3 W4645 2/4
No. 9023-1985.06
ANRITSU
3-113/3-114

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SECTION 1

GENERAL

This service manual describes how to troubleshoot, repair, and adjust the MH951A/MH952A/MH958A/MH968A for the MW920A Optical Time Domain Reflectometer.

SECTION 2 describes how to disassemble and reassemble the plug-in units, and the internal configuration.

SECTION 3 describes how to troubleshoot and repair when a problem occurs during measurements or when abnormalities are detected during performance checks.

SECTION 4 describes how to adjust the plug-in units after repair.

SECTION 5 describes the circuit parts lists and how to order replacement parts.

Refer to the MW920A service manual during servicing.

SECTION 2

MECHANICAL CONFIGURATION

2.1 Introduction

Tables 2-1 and 2-2 list the mechanical parts. Figures 2-1 through 2-6 show disassembled views of the plug-in units.

2.2 Precautions

Always follow the procedure steps below before disassembly and reassembly.

Step	Procedure
1	Turn off the MW920A power switch.
2	Unplug the ac power cord from the ac outlet.
3	Remove the plug-in unit from the MW920A mainframe.

Failure to follow this safety procedure may cause fire and electrical shock hazards that could result in personal injury.

2.3 Cabinet Disassembly

2.3.1 Cover removal (Fig. 2-1.)

Remove the flat-head screws at the top, bottom, and sides of the plug-in unit and remove covers (1) and (2).

2.3.2 Shielding cover removal (Figs. 2-2, 2-5)

Step	Procedure
1	Disconnect A1-J9 & J20, A1-J4 & J2, A2-J2 & J19, A3-J4 & J29, A3-J2 & J3 and A8-J2 & J30.
2	Remove the eight flat-head screws (a in Figs. 2-2 and 2-5) on the front panel.
3	Remove the oval-head screw on the shielding covers ⑥, ⑩, and ⑭ of Fig. 2-2 (MH951A, MH952A), or ⑩, ⑬, and ⑮ of Fig. 2-5 (MH958A).

Table 2-1 Mechanical Parts List (MH951A/MH952A)

Fig. No.	Parts No.	Description	Remarks *	Qty.
Fig. 2-1	① W3B4273	Cover		1
Fig. 2-1	② W2B1096	Cover		1
Fig. 2-1	③ W3B5064	Cover	MH951A ONLY	1
Fig. 2-1	④ 33H3893 (AD)	Prop	MH951A ONLY	4
Fig. 2-1	⑤ W4B14100	Angle	MH951A ONLY	1
Fig. 2-2	⑥ W3B4281 (A)	Cover (3)	MH951A	1
Fig. 2-2	⑦ W3B4281 (B)	Cover (3)	MH952A	1
Fig. 2-2	⑧ W33B4279	Case (3)		1
Fig. 2-2	⑨ W32B4275	Case (1)		1
Fig. 2-2	⑩ W4B8674	Cover (1)		1
Fig. 2-2	⑪ W32B4391	Case (2)		1
Fig. 2-2	⑫ W49H11226	Case		1
Fig. 2-2	⑬ W39H4234 (A)	Optical Output		1
Fig. 2-2	⑭ W4B13335	Cover		1
Fig. 2-2	⑮ W42H12862	Cable		1

Table 2-1 Mechanical Parts List (MH951A/MH952A) (Cont.)

Fig. No.	Parts No.		Description	Remarks	Qty.
Fig. 2-3	(16)	W42H10921	Cap		1
Fig. 2-3	(17)	44Z79621	Spring		1
Fig. 2-3	(18)	W4B10923	Angle		1
Fig. 2-3	(19)	W42B8992	Angle		1
Fig. 2-3	(20)	W4B11205	Plate		1
Fig. 2-3	(21)	W4B11206	Plate		1

Table 2-2 Mechanical Parts List (MH958A/MH968A)

Fig. No.	Parts No.	Description	Remarks	Qty.
Fig. 2-4	(1) W3B4273 (B)	Cover		1
Fig. 2-4	(2) W2B1096 (B)	Cover		1
Fig. 2-4	(3) W39H4373	Optical Output		1
Fig. 2-4	(4) W3B4982	Angle		1
Fig. 2-4	(5) W4B13099	Plate		1
Fig. 2-4	(6) W4B13067	Plate		2
Fig. 2-4	(7) W4J13078	Cable		1
Fig. 2-4	(8) 34H39509 (C)	Prop		4
Fig. 2-5	(9) W33B4388	Case (3)		1
Fig. 2-5	(10) W3B4281 (B)	Cover (3)		1
Fig. 2-5	(11) W32B4391	Case (2)		1
Fig. 2-5	(12) W32B4275	Case (1)		1
Fig. 2-5	(13) W4B8674	Cover (1)		1
Fig. 2-5	(14) W3B4495	Cover (4)		1
Fig. 2-5	(15) W4B11512	Cover (4)		1
Fig. 2-5	(16) W4J13331	Cable		1
Fig. 2-5	(17) W49H11226	Case		1
Fig. 2-6	(18) W3H2919	Cap		1
Fig. 2-6	(19) 44Z79621	Spring		1
Fig. 2-6	(20) W4B10923	Angle		1
Fig. 2-6	(21) W42B8992	Angle		1
Fig. 2-6	(22) W4B11205	Plate		1
Fig. 2-6	(23) W4B11206	Plate		1
Fig. 2-6	(24) W42B11233	Plate		1

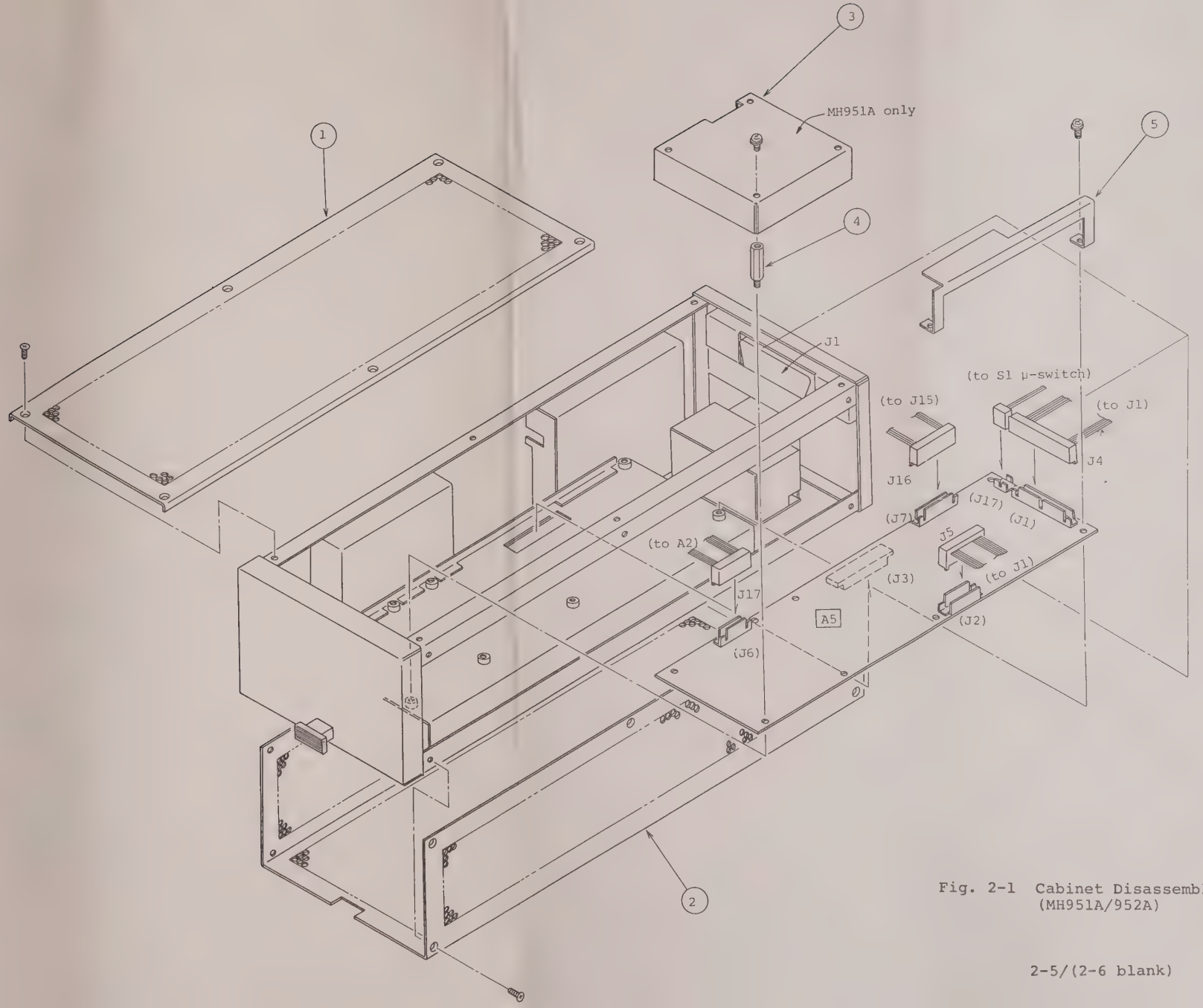


Fig. 2-1 Cabinet Disassembly (MH951A/952A)

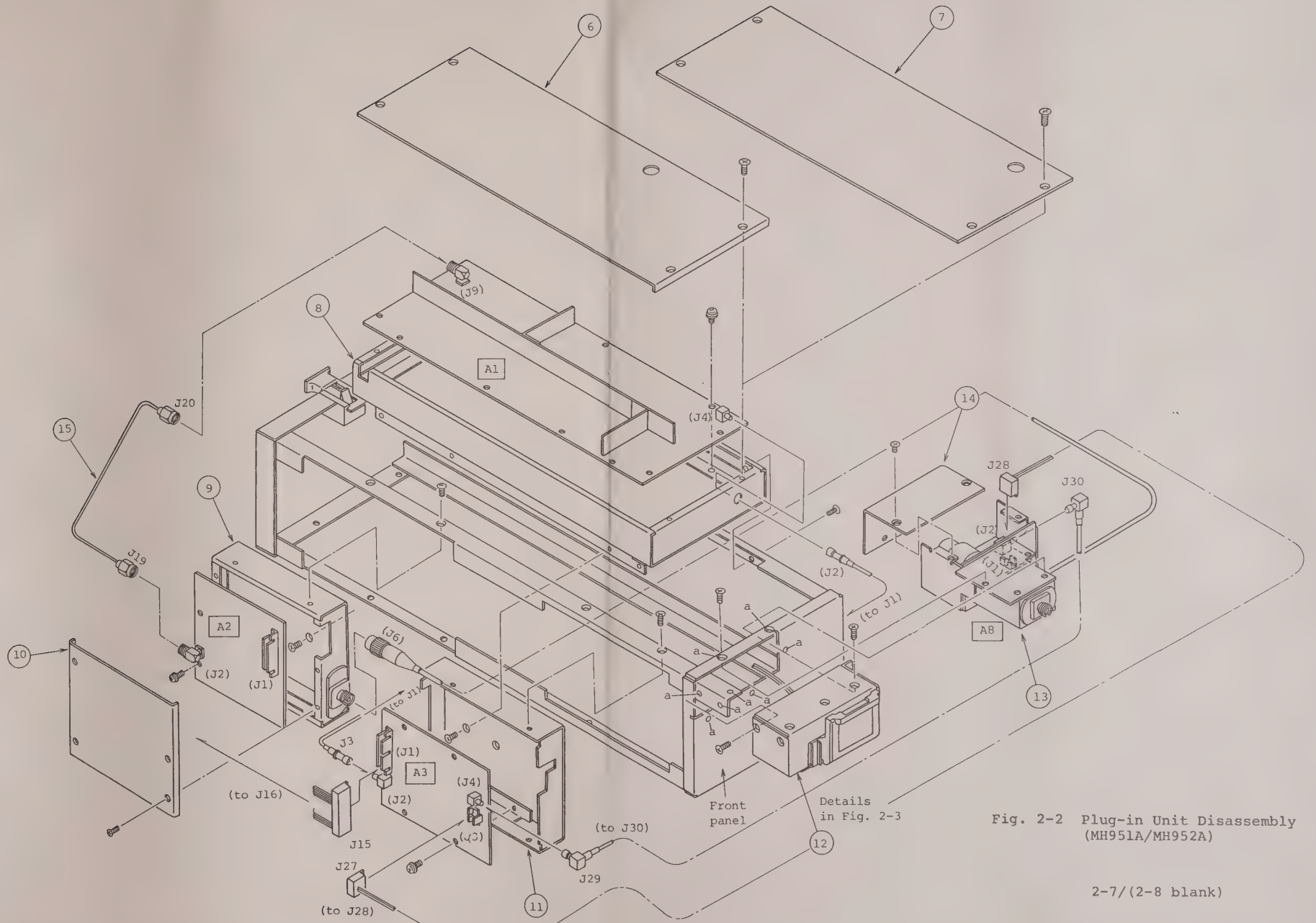


Fig. 2-2 Plug-in Unit Disassembly (MH951A/MH952A)

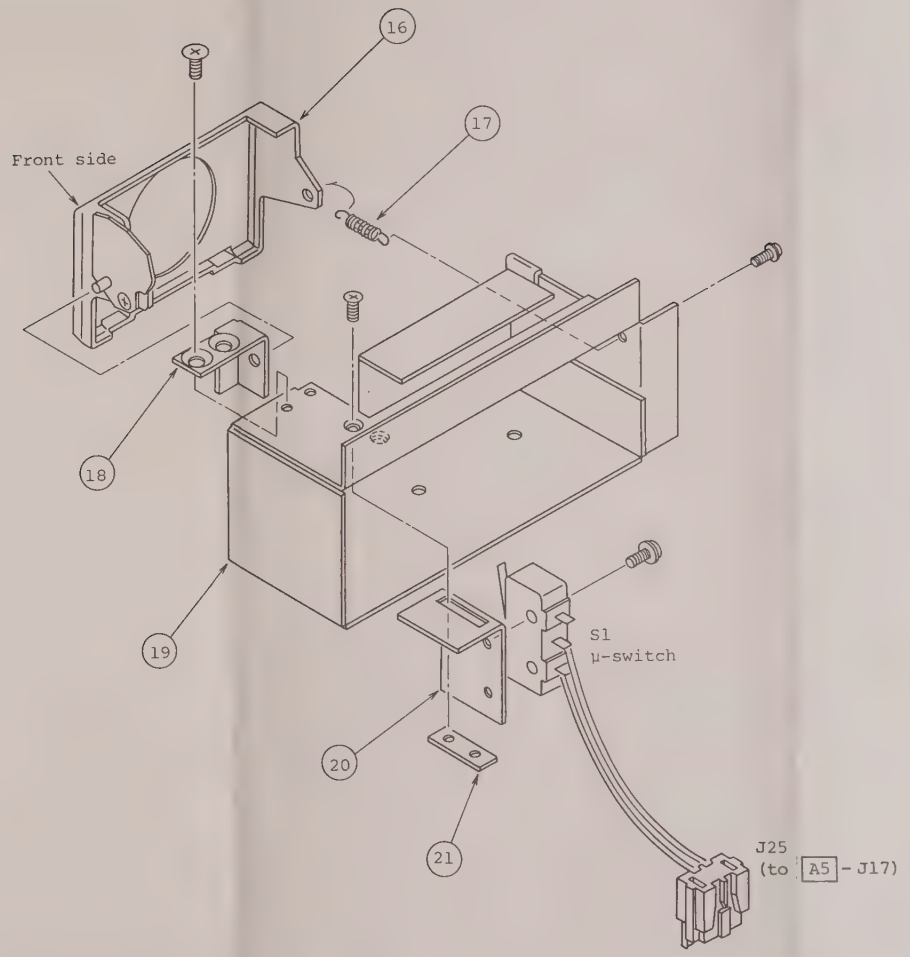


Fig. 2-3 Optical Output Case (12) Disassembly (MH951A/MH952A)

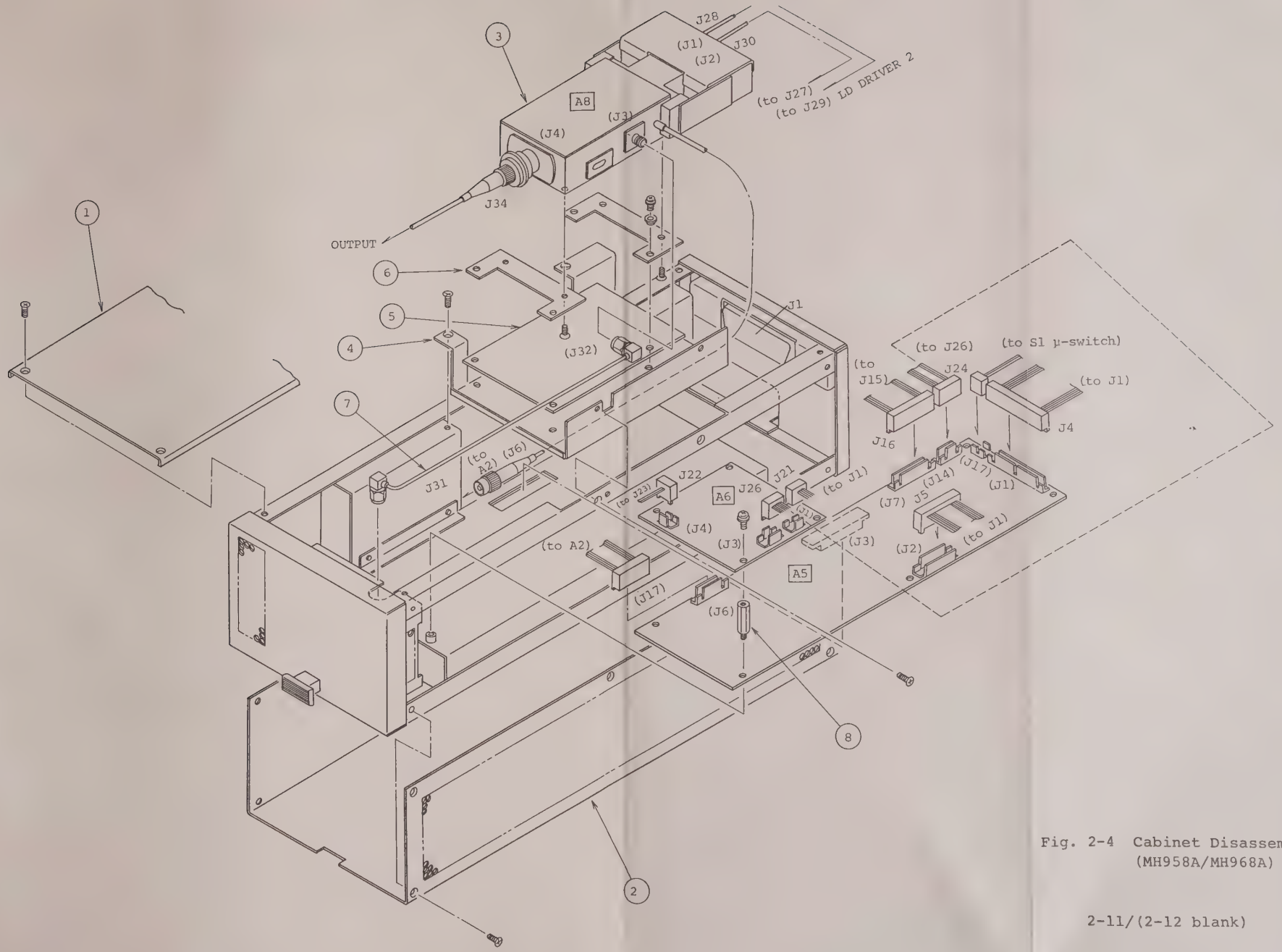


Fig. 2-4 Cabinet Disassembly (MH958A/MH968A)

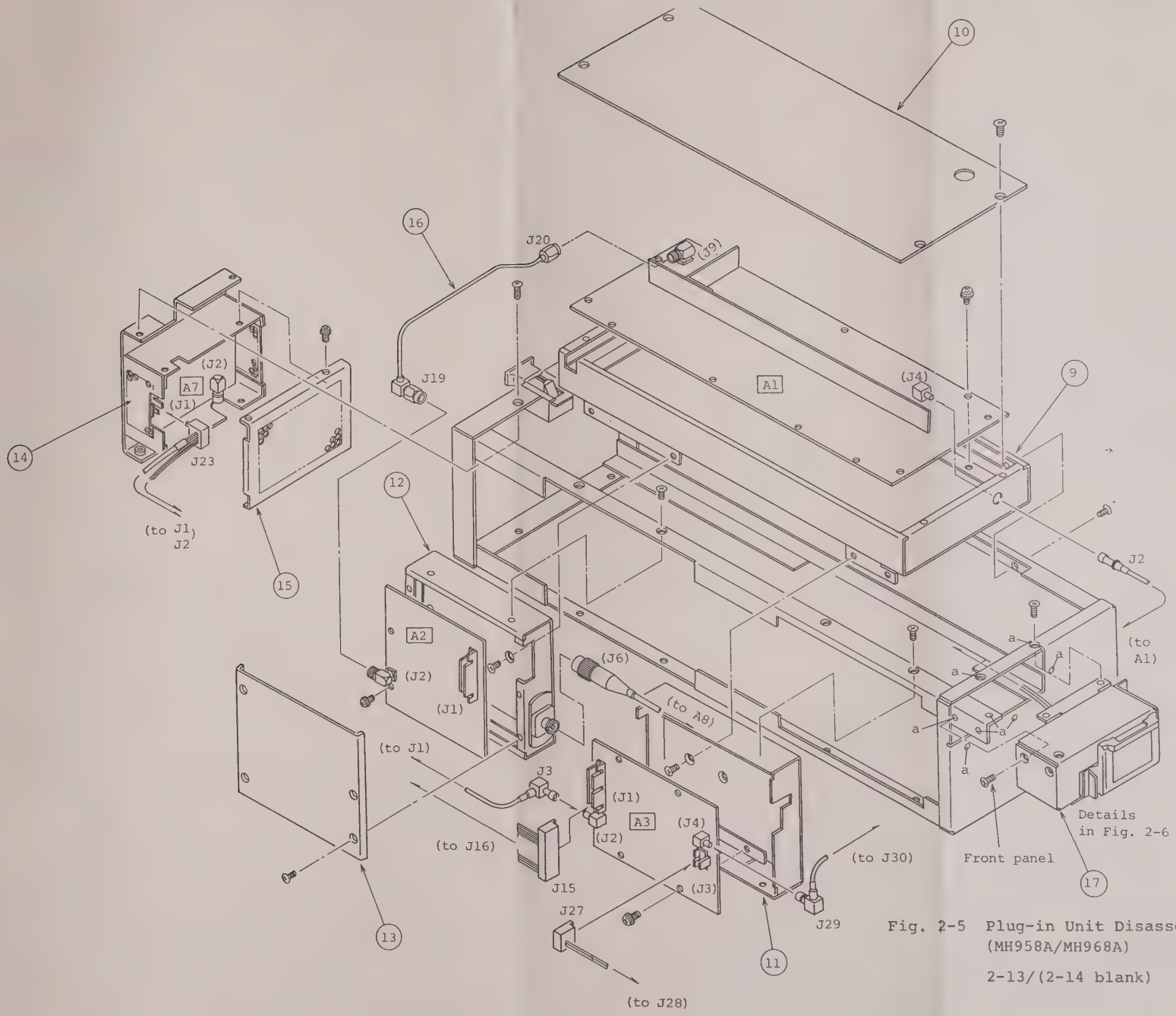


Fig. 2-5 Plug-in Unit Disassembly (MH958A/MH968A)

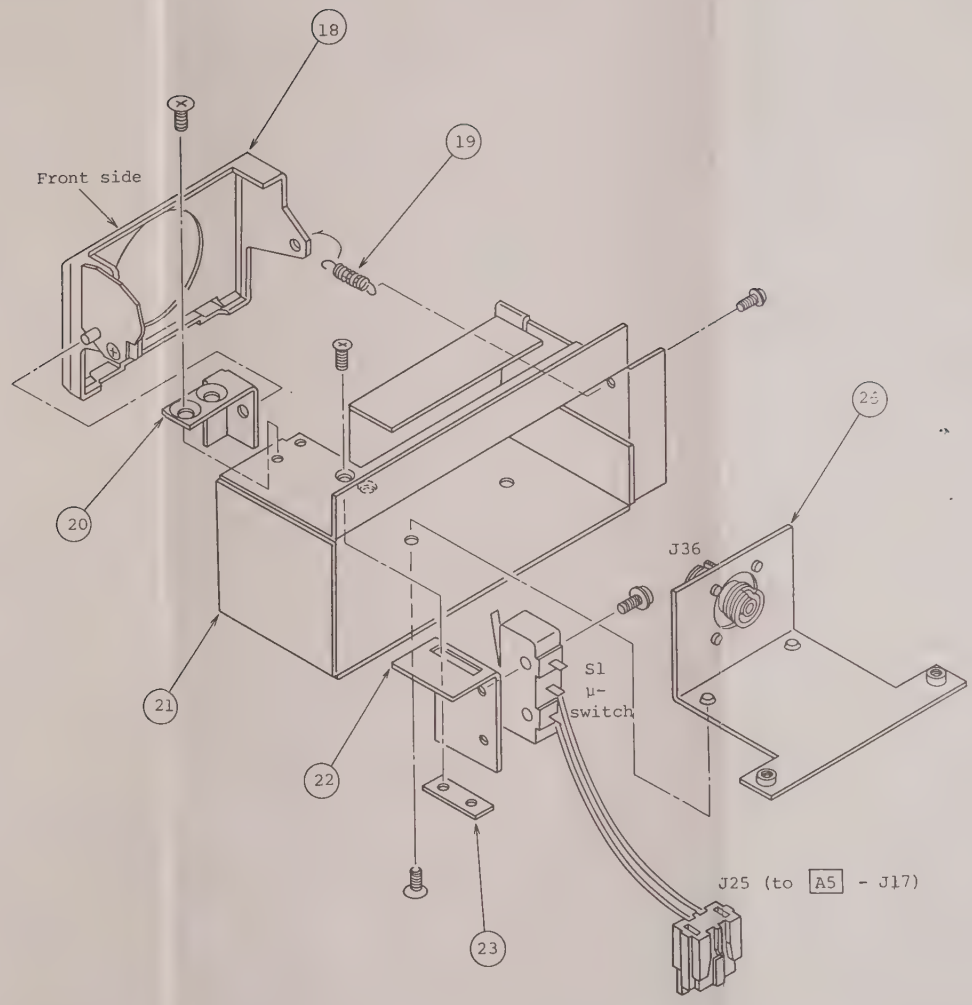


Fig. 2-6 Optical Output Case (17)
Disassembly (MH958A/MH968A)

SECTION 3

TROUBLESHOOTING AND REPAIR

SECTION 3 describes how to troubleshoot and repair problems that occur during measurement or when abnormalities are detected during the performance test.

3.1 Safety Precautions

WARNING

The plug-in units use a laser diode as the light source. Do not look directly into the laser radiation emitted from the OUTPUT.

An OUTPUT connector protective cover is provided to protect the operator.

(1) Insert or remove the plug-in unit only when the MW920A POWER switch is set to OFF. Confirm that the plug-in unit is locked in after inserting it.

(2) Always ground the ground terminal (⏚) on the MW920A main frame rear panel to prevent an accidental electric shock.

(3) Never touch the connectors of the plug-in unit or insert metal items into it while the power is on.

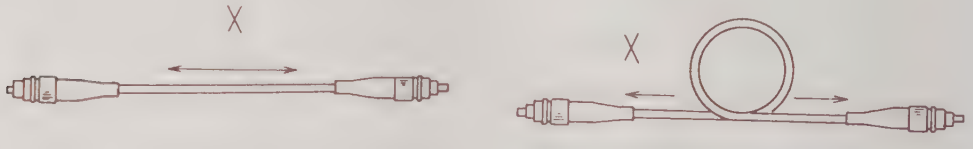
(4) Do not plug the power cord into the ac outlet when the power switch is on.

(5) Ensure that the ac line voltage is the same as that set by the VOLTAGE SELECTOR switches on the rear panel of the MW920A. Also confirm that the correct fuse is being used (refer to the MW920A operation manual.)

Notes:

Precautions on handling optical fiber cable and optical connectors

1. Do not pull the optical fiber cable too hard or bent it too sharply.



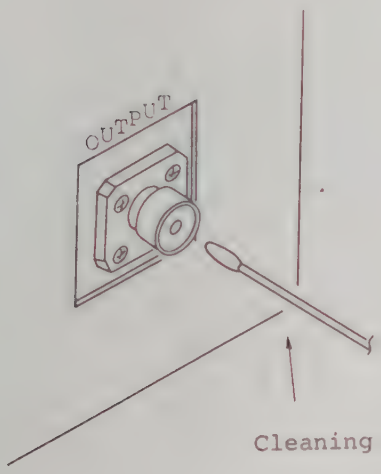
2. Do not twist the fiber cable where it is connected to the optical connector.

3. Confirm that there is no dust or condensation on the optical adapter or plug. Be especially careful of the fiber terminal surface. Use caps and always keep the parts clean. An applicator moistened with alcohol should be used for cleaning.

Notes: (cont.)

4. If the fiber under test is connected to the OUTPUT connector and no trace is displayed on the CRT although the ON/OFF switch is on and the LED is on, it may be due to dust in the connector, or the fiber under test may be broken near the measured section.

   Clean the connector terminal surface or use another cable.



Cleaning with an applicator

Cleaning the terminal surface

3.2 Check and Parts Replacement

3.2.1 Explanation of identification markings on PC boards

As shown in Fig. 3-1, each PC board has a A number, PC board number with revision number, PC board name, parts number, and check points with check point names.

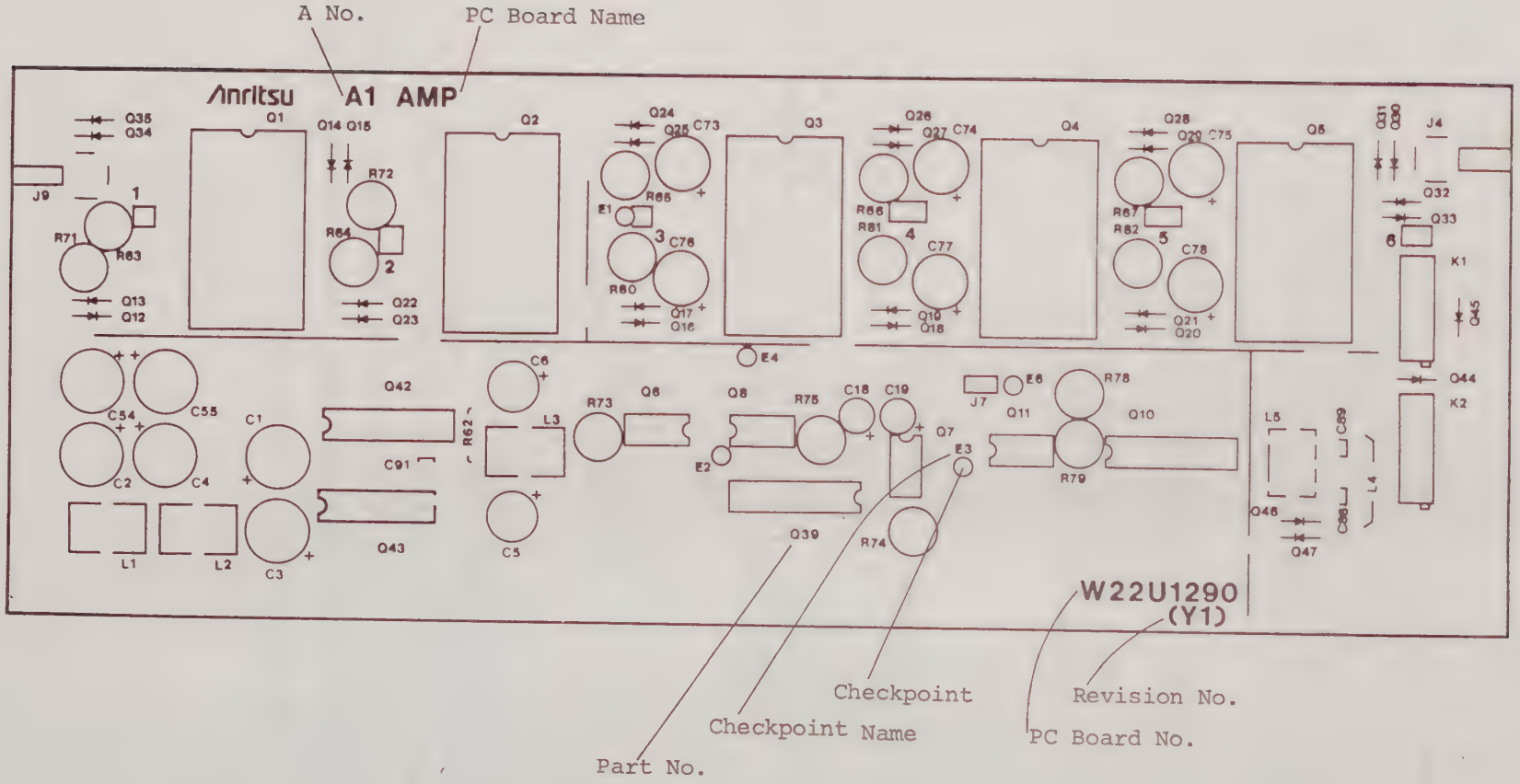


Fig. 3-1 Identification Marking on PC Board

3.3 Recommended Test Equipment

Table 3-2 lists the recommended test equipment for troubleshooting and adjustment.

Table 3-2 Recommended Test Equipment for Troubleshooting and Adjustment

Equipment and Tool	Required Specifications	Recommended Equipment (Anritsu)
Digital multimeter	Voltage range: 0 to 300 Vdc	
Oscilloscope	Frequency range: Dc to 300 MHz	
50 Ω feed-through terminator	50 Ω	
20 dB electronic attenuator	20 dB	
BNC-OSM cord	BNC and OSM connectors at cord ends.	
Optical powermeter with optical sensor	Wavelength range: 0.75 to 1.8 µm Level range: -10 to +20 dBm	ML910A with MA9302A
Optical attenuator	0.85 µm band Graded-index fiber Maximum attenuation: 60 dB	MN95C or MN938A
	1.3 µm band Graded-index fiber Maximum attenuation: 60 dB	MN95D or MN938A
	1.3 µm/1.55 µm band Single-mode fiber Maximum attenuation: 60 dB	MN924A or MN939A

Table 3-2 Recommended Test Equipment for Troubleshooting and Adjustment (Cont.)

Equipment and Tool	Required Specifications	Recommended Equipment (Anritsu)
Optical fiber cable 1	Graded-index fiber 1 to 2 m	
	Single-mode fiber 1 to 2 m	
Optical fiber cable 2	Multi-mode fiber Approx. 10 m	
	Single-mode fiber Approx. 10 m	
Optical fiber cable 3	Graded-index fiber Approx. 10 km	
	Single-mode fiber Approx. 10 km	
Optical fiber cable 4	Graded-index fiber 1 to 2 km	
	Single-mode fiber 1 to 2 km	
Waveform monitor	Wavelength range: 0.5 to 1.1 µm	MP95A
	Wavelength range: 1.0 to 1.6 µm	MP96A
Stabilized light source	Wavelength: 0.85 µm Laser diode	MG9801A
	Wavelength: 1.3 µm Laser diode	MG921A or MG9301A
	Wavelength: 1.55 µm Laser diode	MG923A
Coaxial cord	BNC connector and alligator clip at cord ends	

3.4 Service Kit

For troubleshooting and repairing each plug-in unit, one extender cable described in Table 3-3 is sold separately.

Table 3-3 Service Kit

No.	Name	Remarks
1	Extender cable (W49H11646)	Connection between MW920A and plug-in unit

3.5 Block Diagram and Overall Troubleshooting

Before troubleshooting the plug-in unit, first troubleshoot the MW920A according to the MW920A service manual.

If the plug-in unit is believed to be faulty, perform subsequent troubleshooting while it is connected to the MW920A with the extender cable described in paragraph 3.4.

3.5.1 Circuit reference

The PC boards of the MH951A/MH952A/MH958A/MH968A have A numbers such as A1 and A2. Table 3-4 lists the circuit diagram numbers, circuit diagram names, A numbers, and PC board numbers.

Table 3-4 Circuit Reference

Circuit Diagram No.	Name	A-No.	PC board No.			
			MH951A	MH952A	MH958A	MH968A
1	MH951A/MH952A/ MH958A/MH968A	———	———	———	———	———
2	AMP	A1	W22U1178	W22U1290	W22U1359	W22U1359
3	RECEIVER	A2	———	———	———	———
4	I/V CONV	A2-A1	W42U8713	W42U8713	W42U8713	W42U8713
5	LD DRIVER-2	A3	W42U13341	W42U13341	W42U11532	W42U11532
6	CONT & APD	A5	W32U4228	W32U4228	W32U4228	W32U4228
7	LD UNIT	A8	———	———	———	———
8	LD DRIVER-1	A8-A1	W42U13472	W42U13472	W42U11530	W42U11530
9	AO TIMING	A6	———	———	W42U11534	W42U11534
10	AO DRIVER	A7	———	———	W42U11536	W42U11536

Notes:

1. A6 AO TIMING and A7 AO DRIVER are provided in the MH958A and MH968A.
2. For the part list, see Table 5-1.

3.5.2 Overall circuit description

Figure 3-3 shows the plug-in unit block diagram. The MH951A and MH952A plug-in units consist of LD and APD optical modules, and five PC boards: A1 AMP; A2-A1 I/V CONV; A3 LD DRIVER-2; A5 CONT & APD; and A8-A1 LD DRIVER-1.

The MH958A and MH968A plug-in unit consist of LD and APD optical modules and seven PC boards: A1 AMP; A2-A1 I/V CONV; A3 LD DRIVER-2; A5 CONT & APD; A6 AO TIMING; A7 AO DRIVER; and A8-A1 LD DRIVER-1.

Power is supplied to the PC boards from the MW920A power supply unit via A5 CONT & APD which also generates part of the power supply.

The I/O port is provided with A5 CONT & APD. The input port detects the type of the plug-in unit and whether the LASER OUTPUT cover is opened or closed. The output port selects the pulse width, switches ATT and filter, and controls the amplifier section offset voltage.

The APD bias voltage is controlled by A5 CONT & APD and is supplied to the APD anode via A2-A1 I/V CONV.

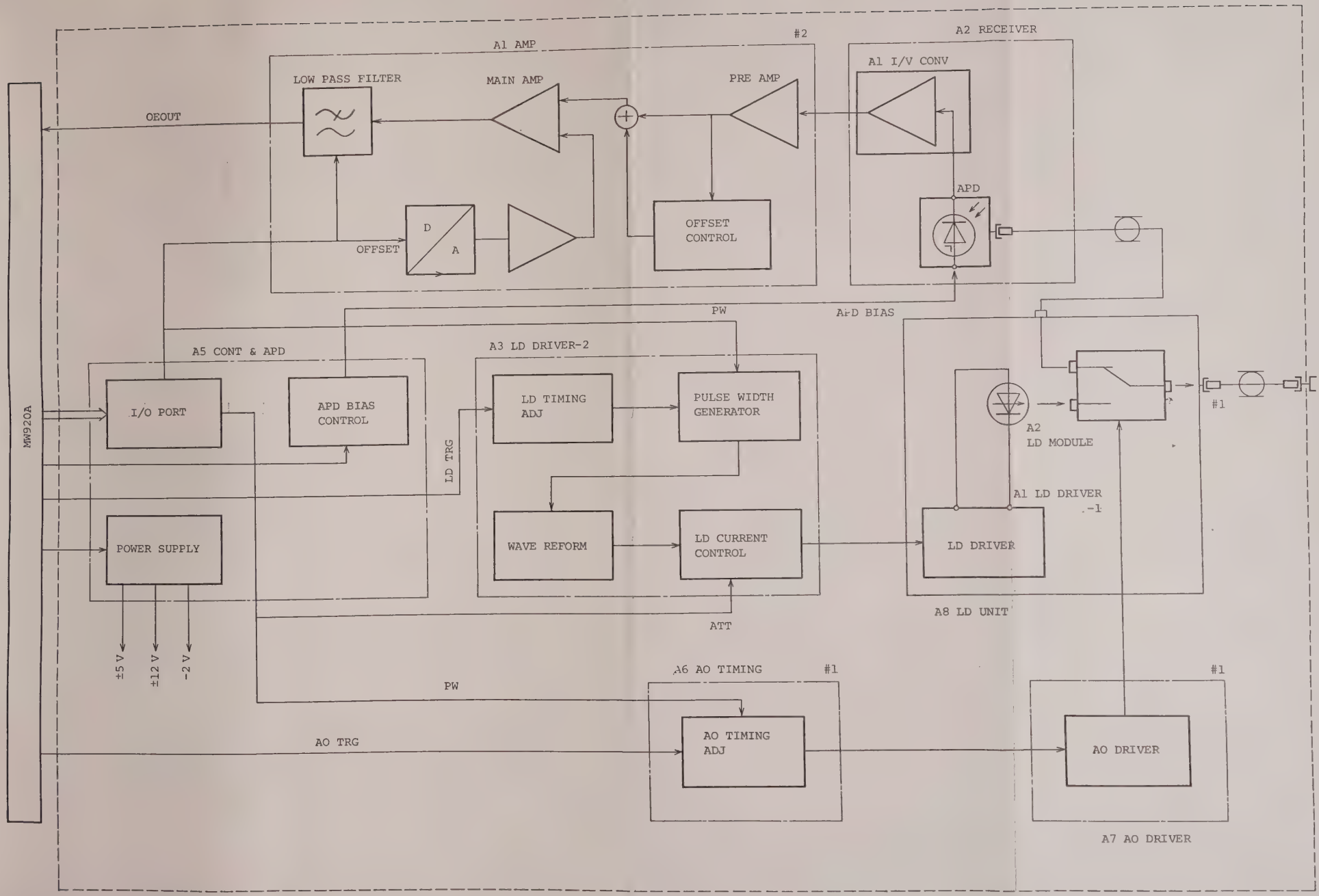
The MH958A/MH968A has an acousto-optic (AO) switch built into it which requires a driver circuit. It receives a timing signal from the MW920A and, after the timing is adjusted in A6 AO TIMING, inputs it to A7 AO DRIVER. A7 AO DRIVER turns the AO switch, built into A8 LD UNIT, on or off according to the input signal.

An optical pulse output emission trigger is received from the MW920A and drives the laser diode (LD) with A3 LD DRIVER-2 and A8-A1 LD DRIVER-1. The optical pulse emitted from the A8 LD UNIT is input to the fiber to be measured.

The back-scattered light and Fresnel reflected light from the measured fiber are branched in the A8 LD UNIT and input to the APD. The APD output current is converted to voltage at A2-A1 I/V CONV and the voltage is input to A1 AMP. The A1 AMP output waveform is processed and displayed after it is input to the MW920A.

3.5.3 Block diagram

Figure 3-3 shows the block diagram of the plug-in units.



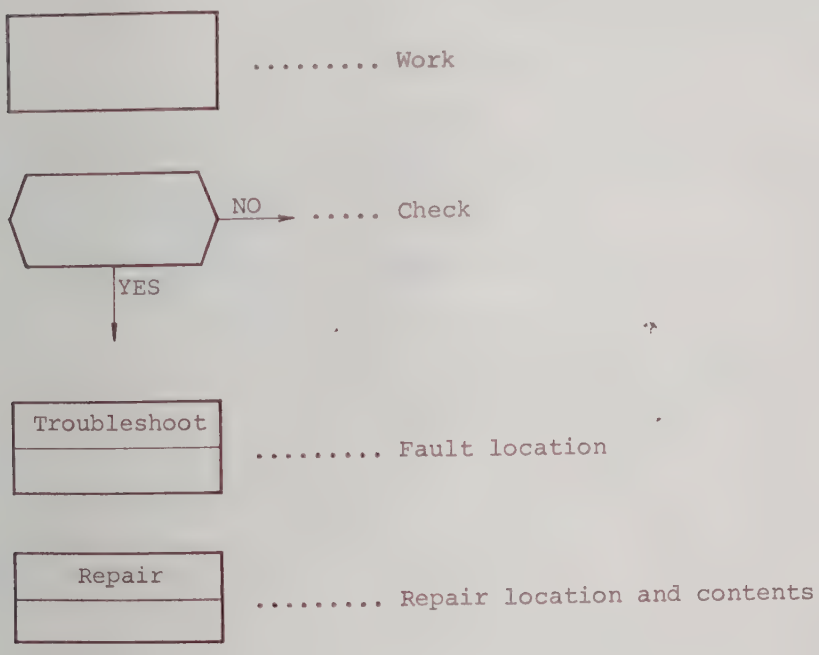
Note: #1 FOR MH958A/MH968A ONLY
#2 FOR MH952A ONLY

Fig. 3-3 MH951A/MH952A/MH958A/MH968A Block Diagram

3.5.4 Overall troubleshooting and repair

(1) Flowchart symbols

The flowcharts in the SECTION 3 use the symbols shown below to help explain the troubleshooting procedure.



Note:

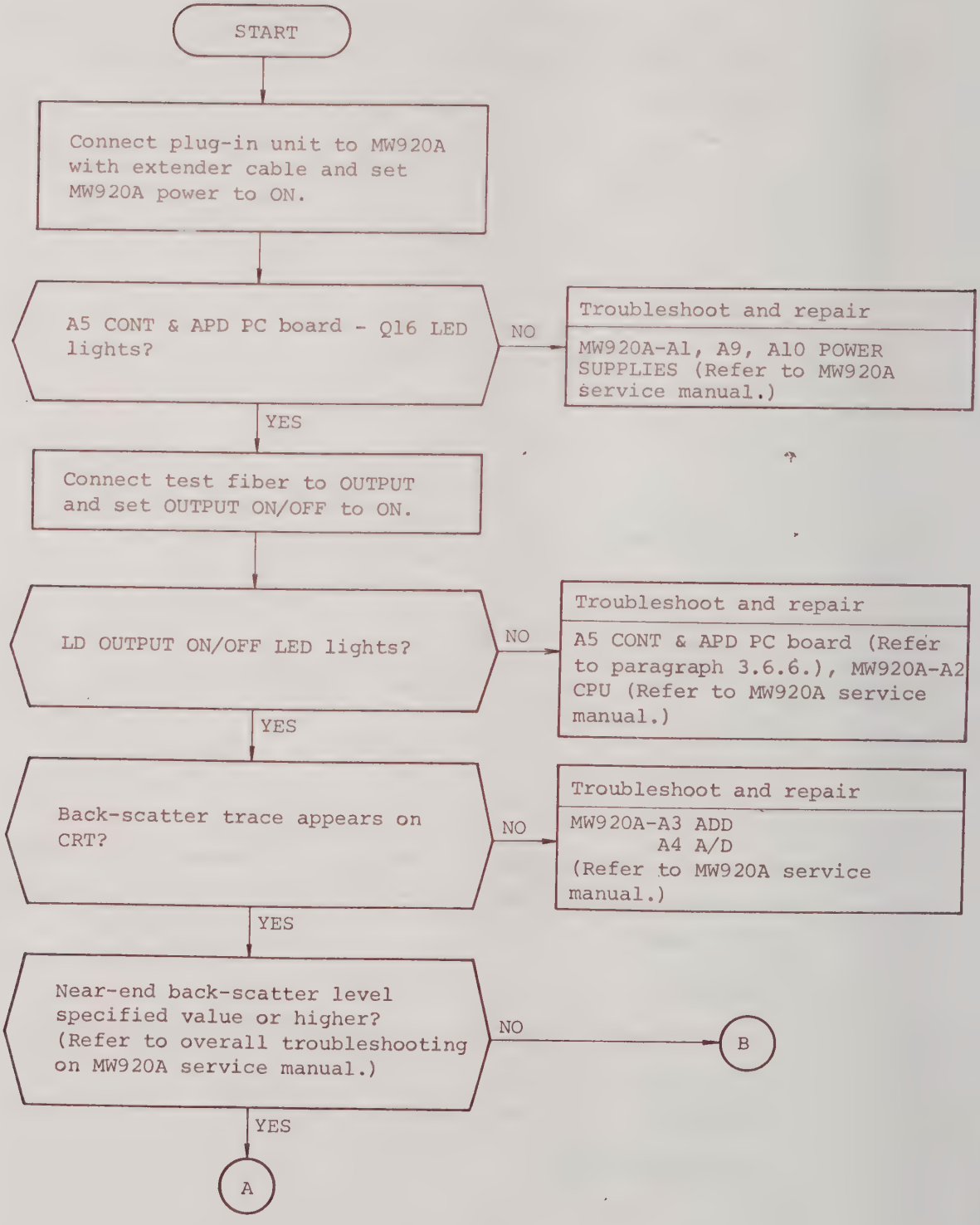
Explanations described inside the ⬭ symbols are setting conditions for the MW920A or oscilloscope, if anything is not noticed.

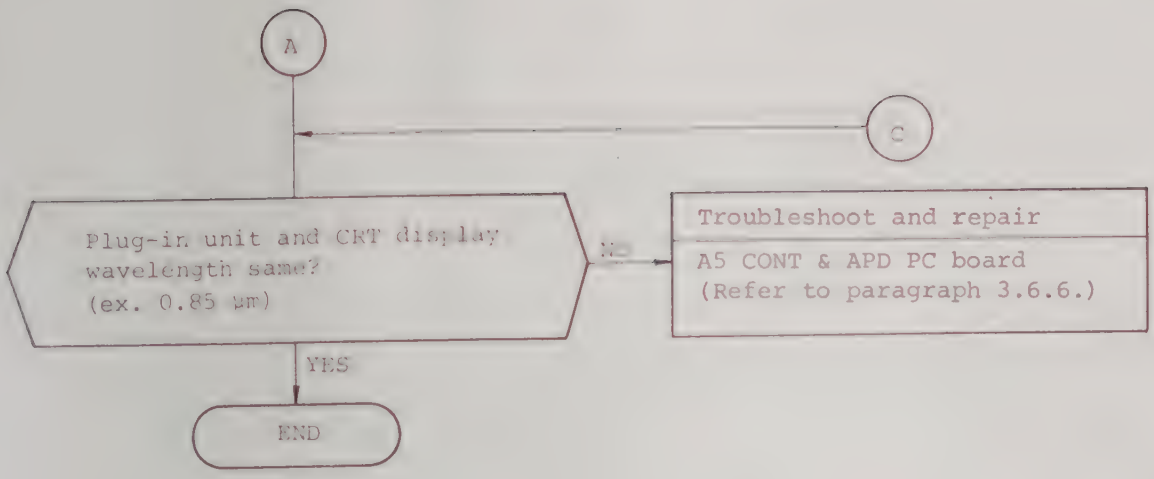
(Example)

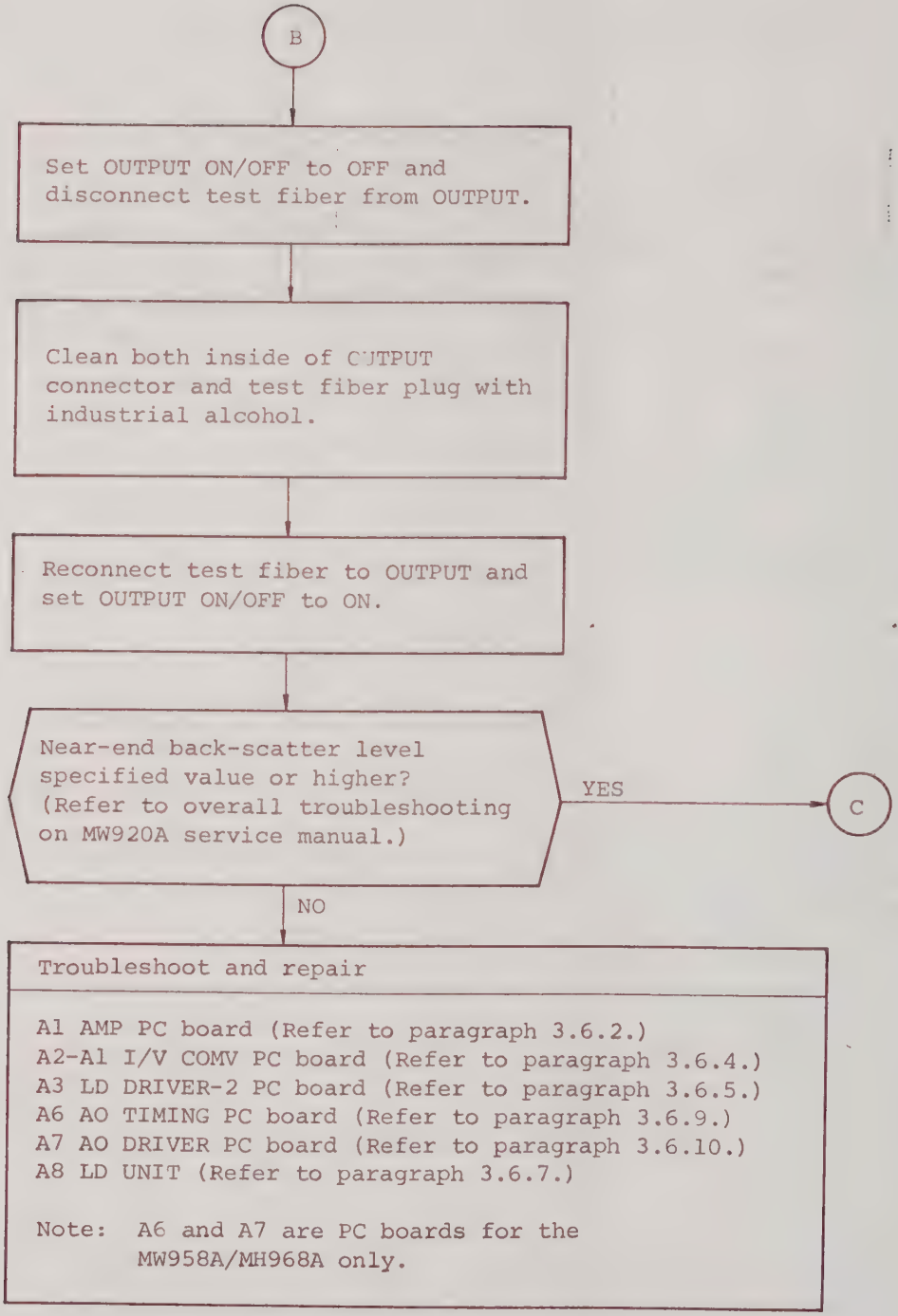
Dr = 40 km — Distance Range 40 km (MW920A setting)

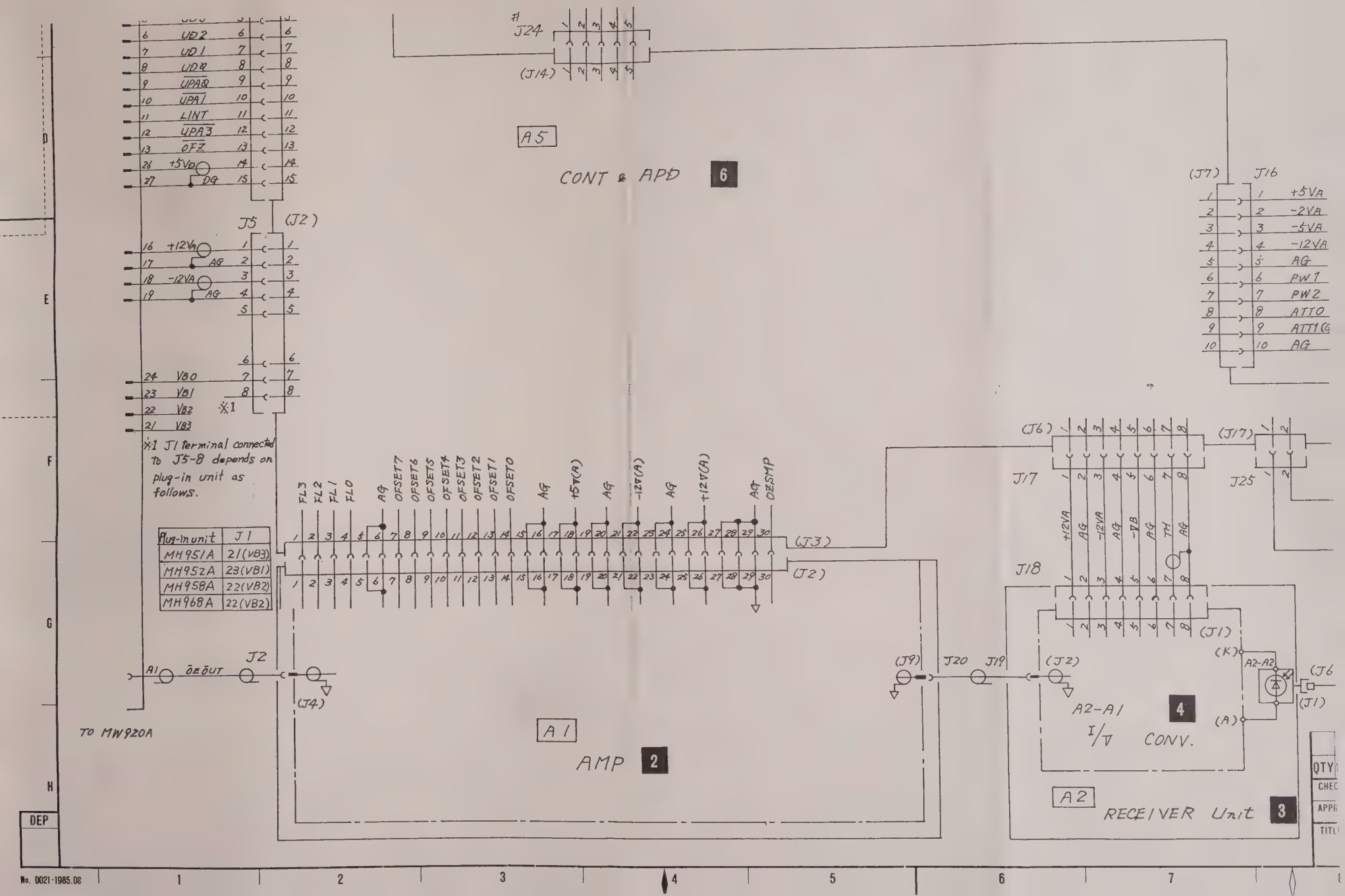
20 mV/DIV
50 µs/DIV
TRG = "SNDTRG"
} Oscilloscope settings

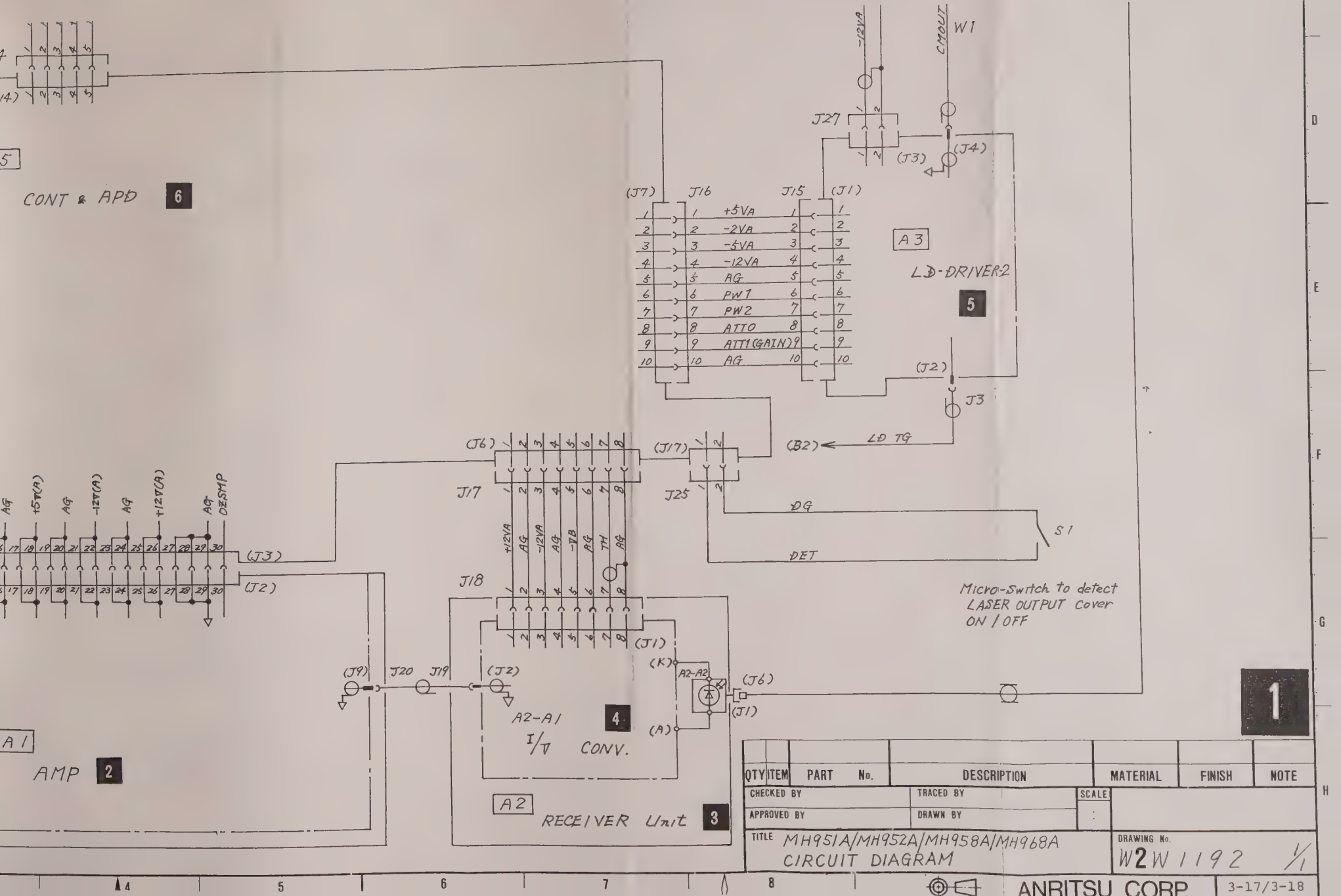
(2) Main flowchart of overall troubleshooting and repair


START
Connect plug-in unit to MW920A with extender cable and set MW920A power to ON.
A5 CONT & APD PC board - Q16 LED lights?
NO
Troubleshoot and repair
MW920A-A1, A9, A10 POWER SUPPLIES (Refer to MW920A service manual.)
YES
Connect test fiber to OUTPUT and set OUTPUT ON/OFF to ON.
LD OUTPUT ON/OFF LED lights?
NO
Troubleshoot and repair
A5 CONT & APD PC board (Refer to paragraph 3.6.6.), MW920A-A2 CPU (Refer to MW920A service manual.)
YES
Back-scatter trace appears on CRT?
NO
Troubleshoot and repair
MW920A-A3 ADD
A4 A/D
(Refer to MW920A service manual.)
YES
Near-end back-scatter level specified value or higher? (Refer to overall troubleshooting on MW920A service manual.)
NO
B
YES
A


A
C
Plug-in unit and CRT display wavelength same?
(ex. 0.85 μm)
NO
Troubleshoot and repair
A5 CONT & APD PC board
(Refer to paragraph 3.6.6.)
YES
END


B
Set OUTPUT ON/OFF to OFF and disconnect test fiber from OUTPUT.
Clean both inside of OUTPUT connector and test fiber plug with industrial alcohol.
Reconnect test fiber to OUTPUT and set OUTPUT ON/OFF to ON.
Near-end back-scatter level specified value or higher? (Refer to overall troubleshooting on MW920A service manual.)
YES
C
NO
Troubleshoot and repair
A1 AMP PC board (Refer to paragraph 3.6.2.)
A2-A1 I/V COMV PC board (Refer to paragraph 3.6.4.)
A3 LD DRIVER-2 PC board (Refer to paragraph 3.6.5.)
A6 AO TIMING PC board (Refer to paragraph 3.6.9.)
A7 AO DRIVER PC board (Refer to paragraph 3.6.10.)
A8 LD UNIT (Refer to paragraph 3.6.7.)
Note: A6 and A7 are PC boards for the MW958A/MH968A only.

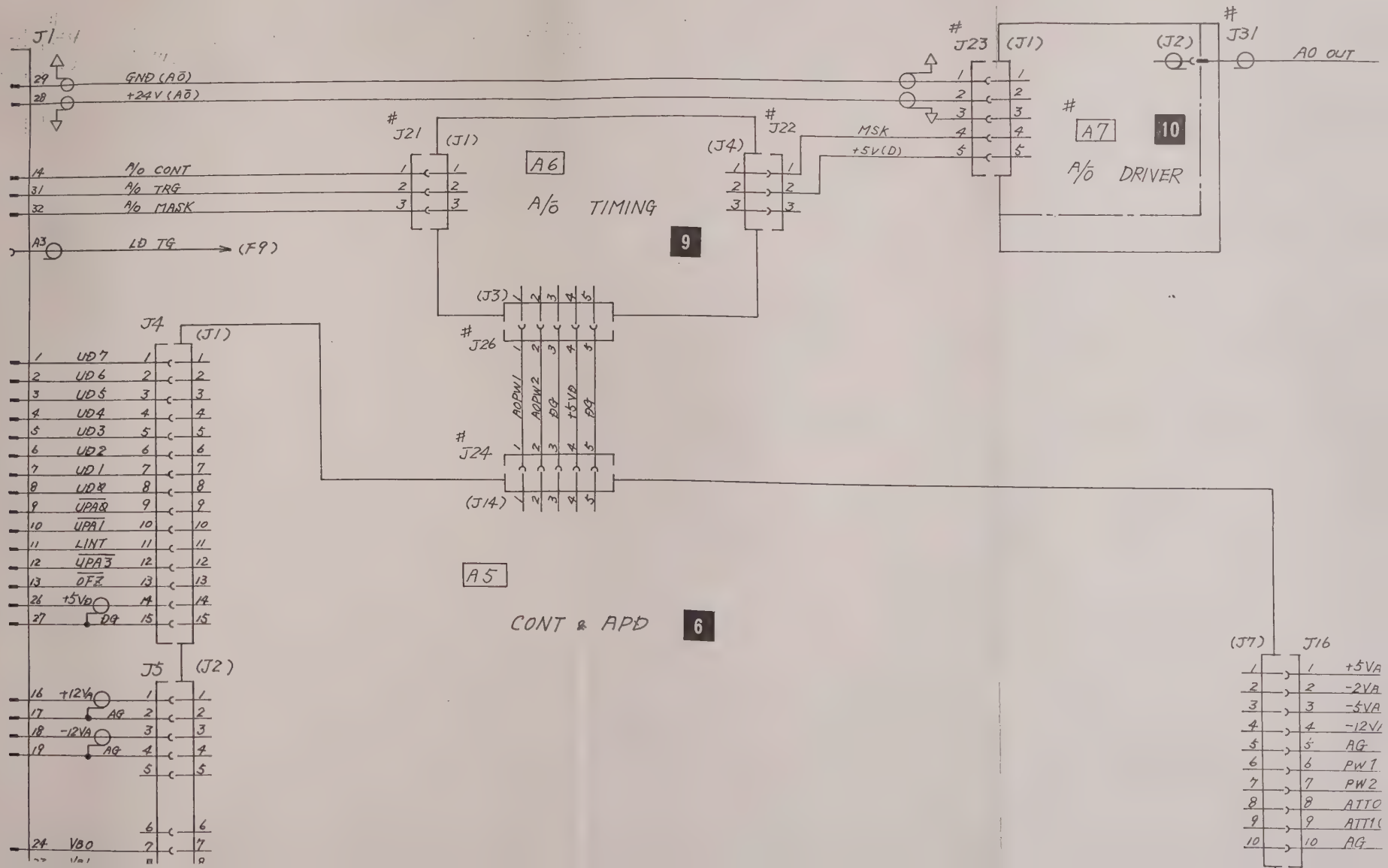

J24
(J14)
A5
CONT & APD 6
(J7) J16
+5VA
-2VA
-5VA
-12VA
AG
PW1
PW2
ATT0
ATT1
AG
J5 (J2)
+12VA
AG
-12VA
AG
VB0
VB1
VB2
VB3
※1
※1 J1 terminal connected to J5-8 depends on plug-in unit as follows.
Plug-in unit | J1
MH951A | 21(VB3)
MH952A | 23(VB1)
MH958A | 22(VB2)
MH968A | 22(VB2)
FL3 FL2 FL1 FL0 AG OFSET7 OFSET6 OFSET5 OFSET4 OFSET3 OFSET2 OFSET1 OFSET0 AG +5V(A) AG -12V(A) AG +12V(A) AG OESMP
(J3)
(J2)
J6 J7 J17 J25
+12VA AG -12VA AG -VB AG TH AG
J18
(J1)
(K)
A2-A2
(J6)
(J1)
(A)
(J9) J20 J19 (J2)
A2-A1 I/V CONV. 4
A2 RECEIVER Unit 3
J2
A1 OEOUT
(J4)
TO MW920A
A1 AMP 2
DEP
QTY
CHEC
APPR
TITL
No. 0021-1985.08


CONT & APD 6
J27
(J3)
(J4)
W1
-12VA
CMOUT
(J7) J16 J15 (J1)
+5VA
-2VA
-5VA
-12VA
AG
PW1
PW2
ATTO
ATT1(GAIN)
AG
A3
LD-DRIVER2
5
(J2)
J3
LD TG
(B2)
(J6)
J17
(J17)
J25
DG
DET
S1
Micro-switch to detect
LASER OUTPUT Cover
ON / OFF
+12VA
AG
-12VA
AG
-5B
AG
TH
AG
J18
(J1)
(K)
A2-A2
(A)
(J6)
(J1)
(J9)
J20
J19
(J2)
A2-A1
I/V CONV.
4
A2
RECEIVER Unit
3
AG
+5T(A)
AG
-12T(A)
AG
+12T(A)
AG
DESMP
(J3)
(J2)
A1
AMP 2
1
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH NOTE
CHECKED BY
TRACED BY
SCALE
APPROVED BY
DRAWN BY
TITLE MH951A/MH952A/MH958A/MH968A
CIRCUIT DIAGRAM
DRAWING No. W2W1192 1/1
ANRITSU CORP
3-17/3-18

APPLICATION

Parts List	W4W12143 (MH951A)
	W4W12144 (MH952A)
	W4W12145 (MH958A, MH968A)

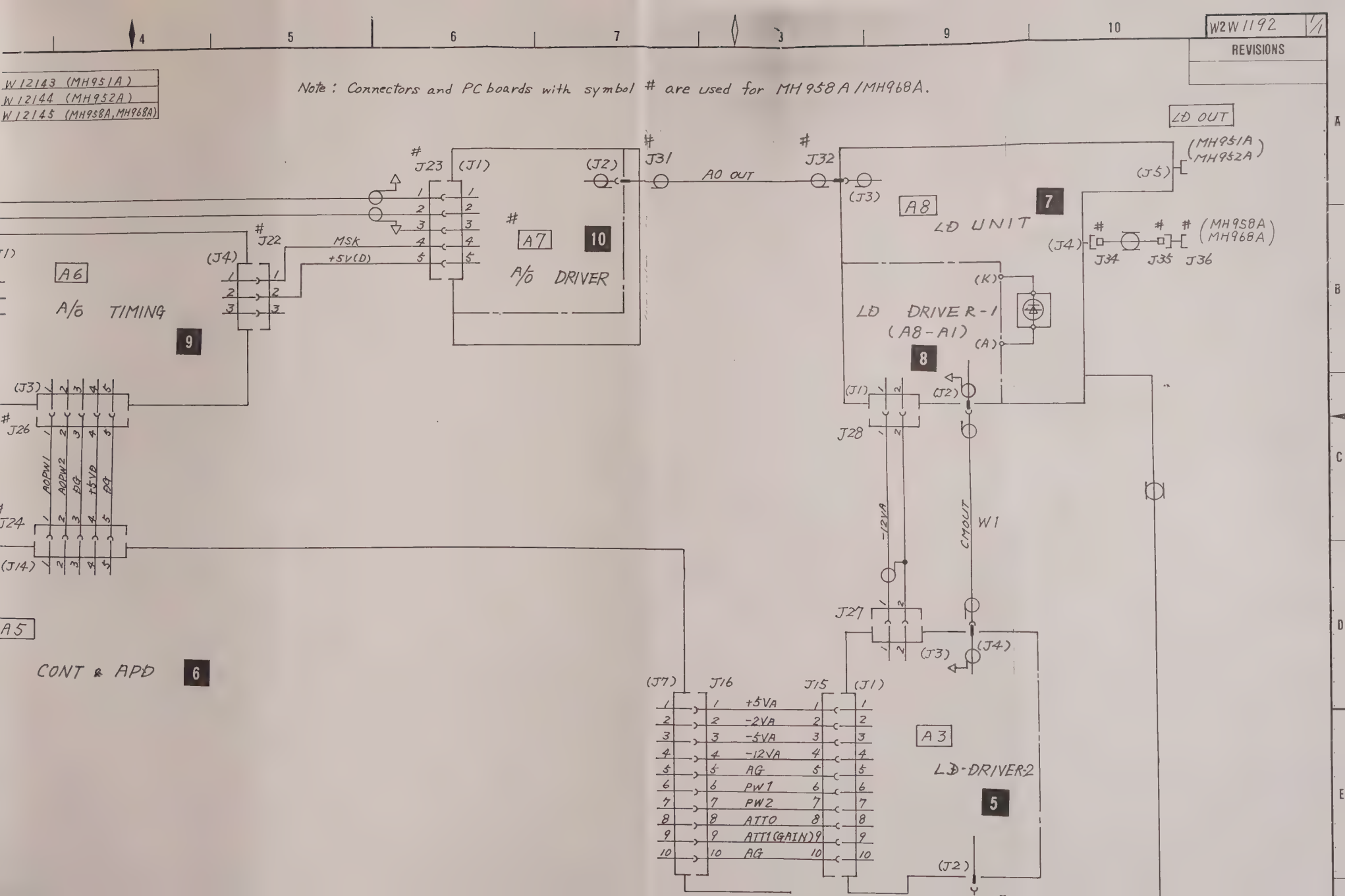
Note : Connectors and PC boards with symbol # are used for



REVISIONS

W12143 (MH951A)
W12144 (MH952A)
W12145 (MH958A, MH968A)

Note : Connectors and PC boards with symbol # are used for MH958A/MH968A.



3.6 Each PC Board Troubleshooting and Repair

3.6.1 Introduction

The plug-in units generate optical pulses by using a laser diode (LD). The optical pulses are supplied to the test fiber through a directional coupler. The back-scattered light and Fresnel reflection are received through the directional coupler by the Avalanche Photodiode (APD), which converts the received light to electrical signals.

Refer to 1 circuit diagram of MH951A/MH952A/MH958A/MH968A plug-in units.

In SECTIONs 3 and 4, a logical voltage is represented as TTL or CMOS logic level. Refer to the voltage values shown in Table 3-5.

Table 3-5 Logic Levels and Voltages

Logic Level	TTL	CMOS
High	$\geqq$2.0 V	$\geqq$3.15 V
Low	$\leqq$0.8 V	$\leqq$1.3 V

3.6.2 A1 AMP 2

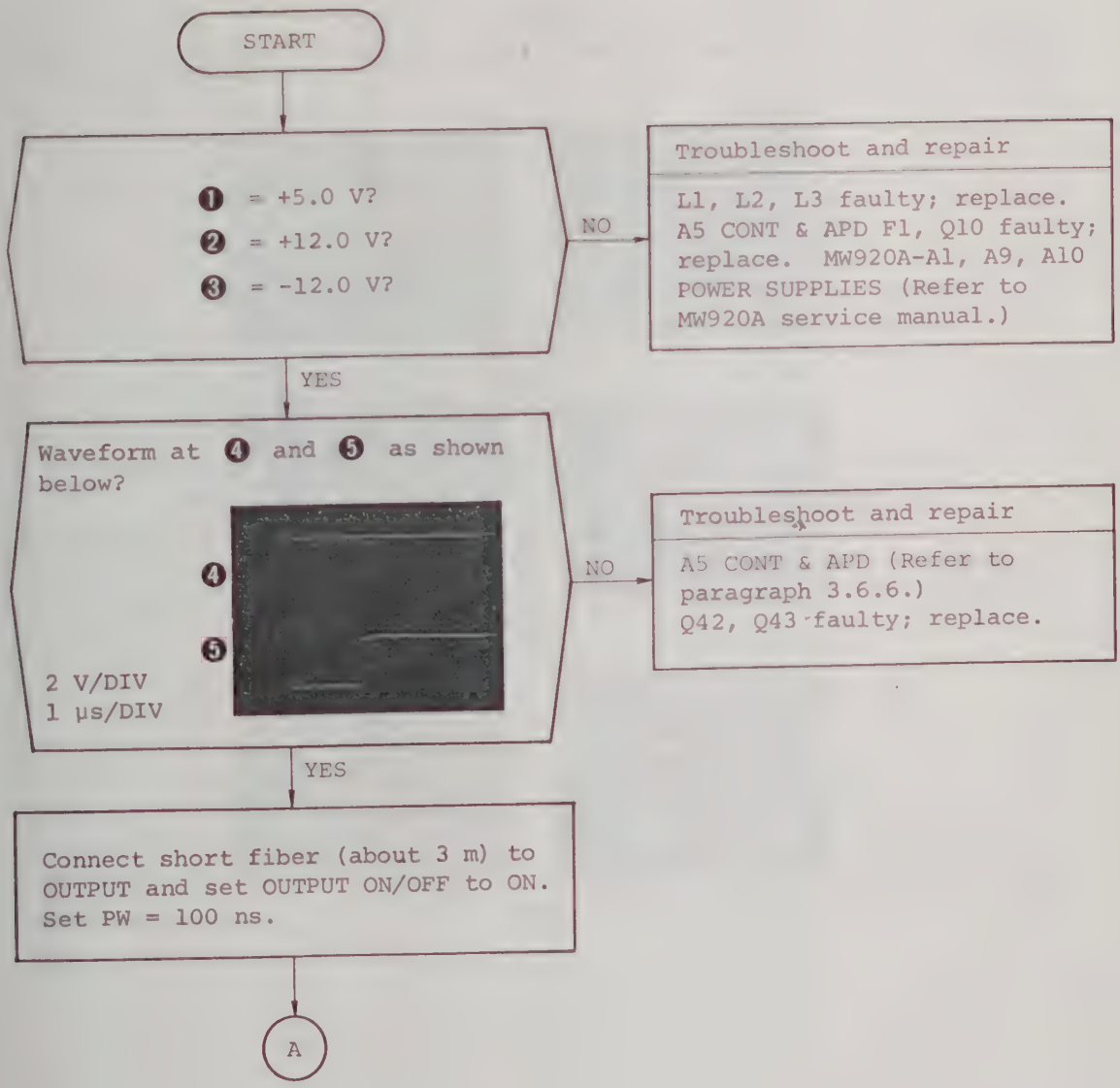
(1) Circuit description

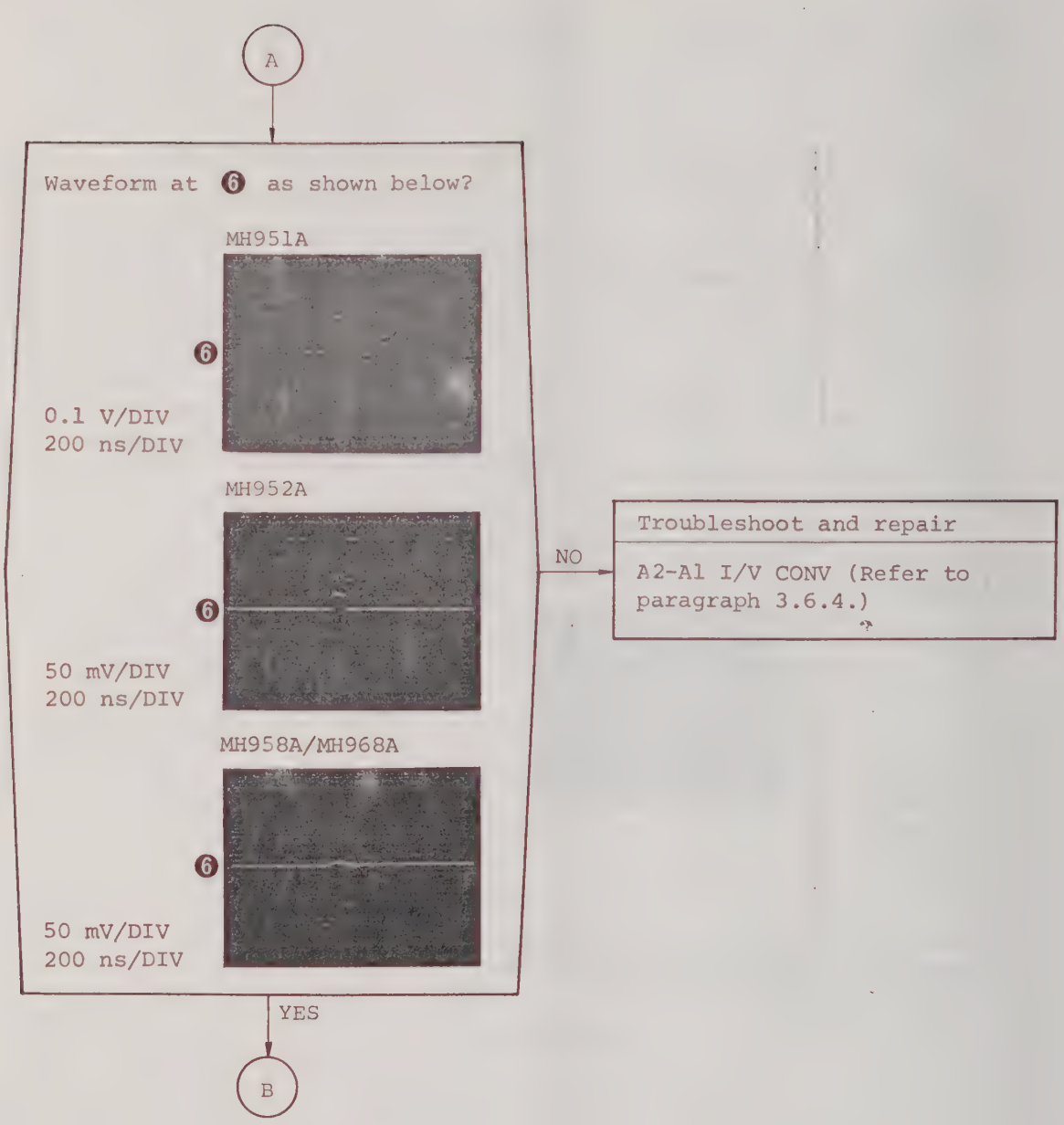
This PC board amplifies the very low signal that is converted to an electrical signal at A2-A1 I/V CONV, to a level just sufficient for display. The amplified signal is input to the MW920A A/D converter.

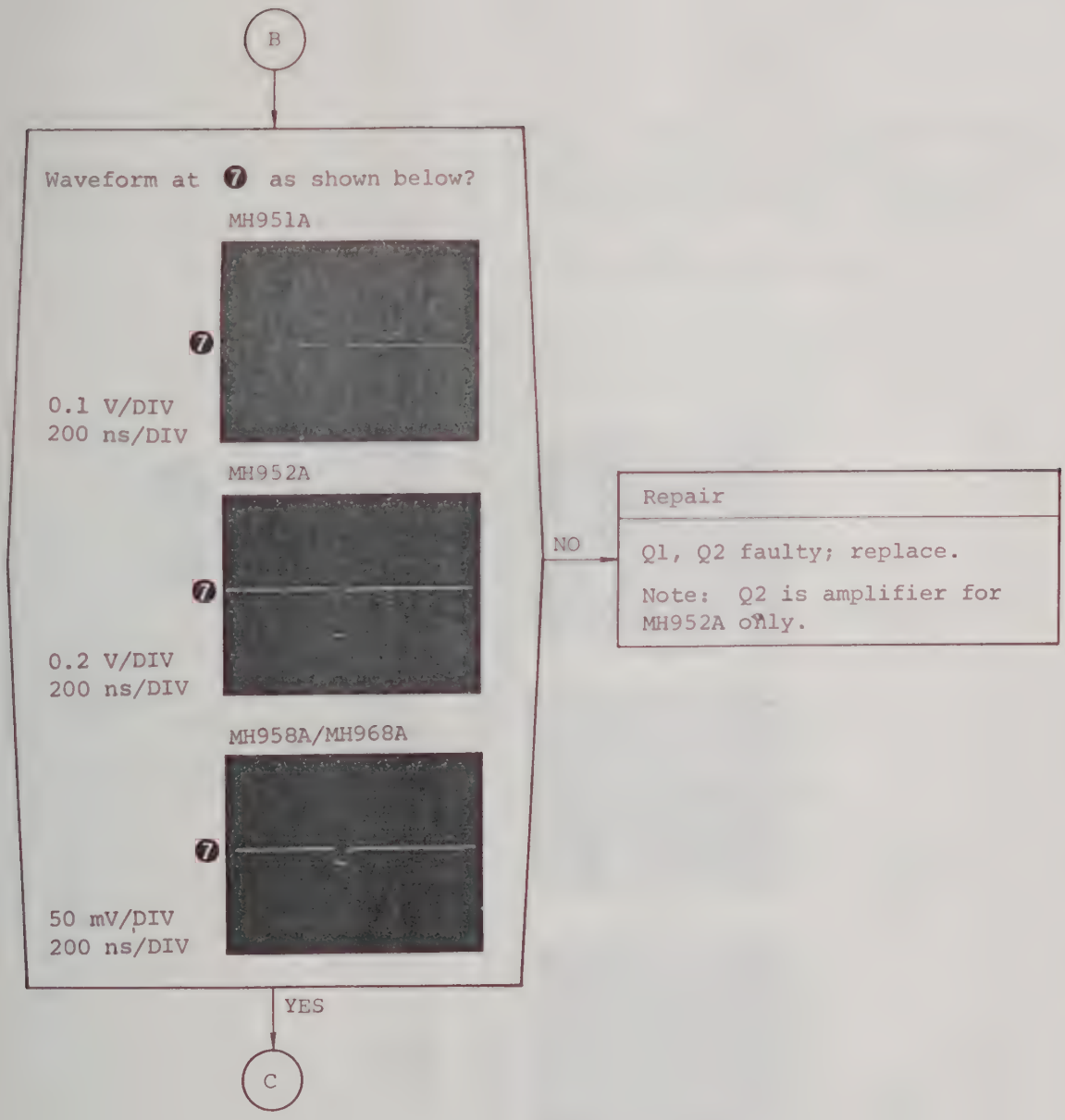
The A2-AI I/V CONV output signal is amplified at the preamplifier section configured by Q1 and Q2. The offset circuit, which consists of Q6, Q7, Q8, and Q39, receives a sampling signal from the MW920A. It then samples and holds the preamplifier output offset voltage, reverses the offset voltage polarity and inputs it to the next main amplifier stage. This cancels the preamplifier offset voltage.

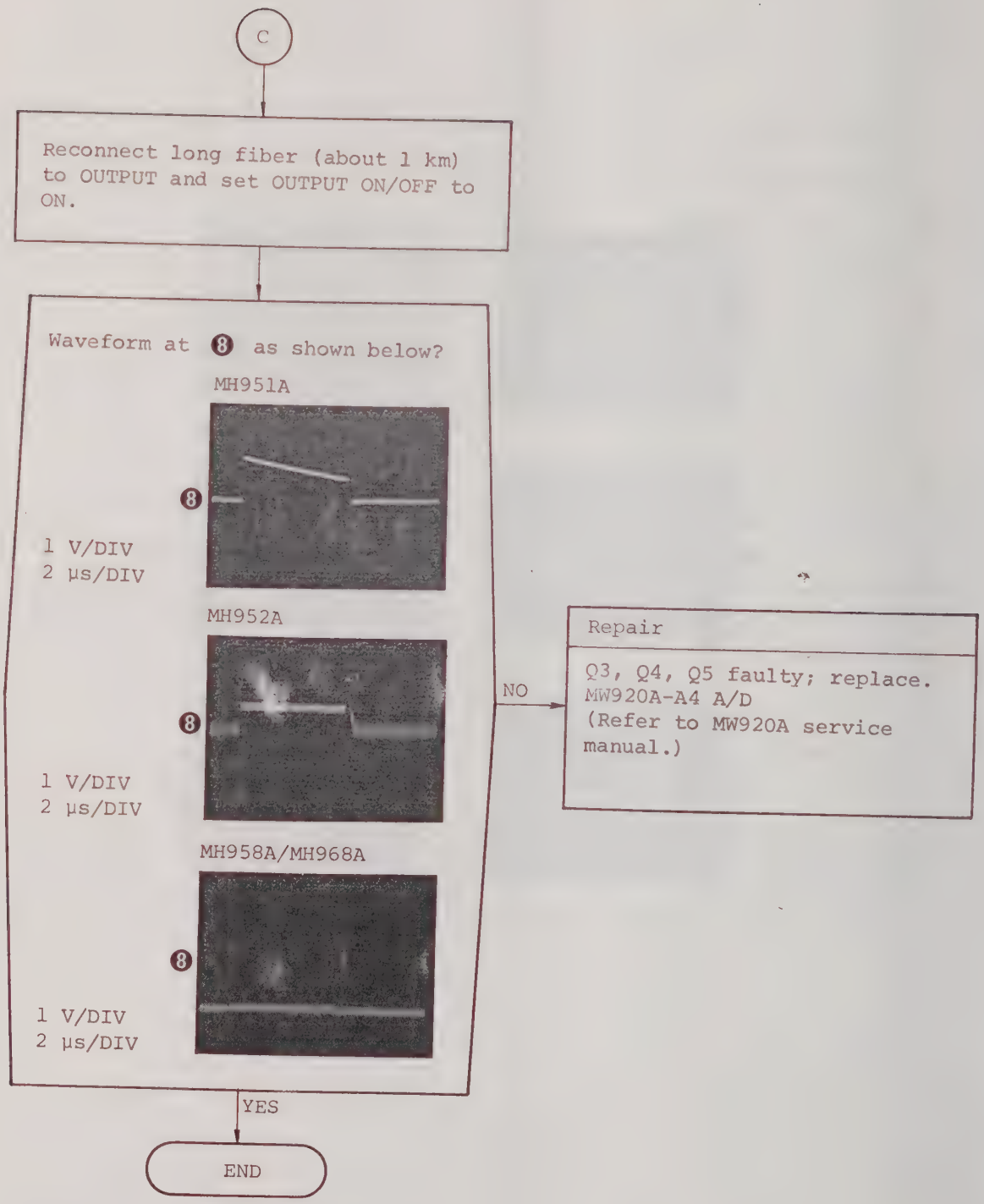
The signal amplified at the preamplifier is further amplified at the main amplifier and input to the MW920A A/D converter. The offset voltage of the main amplifier output is always under supervision by the MW920A CPU. The offset fluctuation is cancelled by a feedback to the main amplifier section through Q10 and Q11 from the CPU.

(2) Troubleshooting and repair


START
❶ = +5.0 V?
❷ = +12.0 V?
❸ = -12.0 V?
NO
Troubleshoot and repair
L1, L2, L3 faulty; replace.
A5 CONT & APD F1, Q10 faulty; replace. MW920A-A1, A9, A10 POWER SUPPLIES (Refer to MW920A service manual.)
YES
Waveform at ❹ and ❺ as shown below?
❹
❺
2 V/DIV
1 µs/DIV
NO
Troubleshoot and repair
A5 CONT & APD (Refer to paragraph 3.6.6.)
Q42, Q43 faulty; replace.
YES
Connect short fiber (about 3 m) to OUTPUT and set OUTPUT ON/OFF to ON.
Set PW = 100 ns.
A


A
Waveform at ❻ as shown below?
MH951A
❻
0.1 V/DIV
200 ns/DIV
MH952A
❻
50 mV/DIV
200 ns/DIV
MH958A/MH968A
❻
50 mV/DIV
200 ns/DIV
NO
Troubleshoot and repair
A2-A1 I/V CONV (Refer to paragraph 3.6.4.)
YES
B


B
Waveform at ❼ as shown below?
MH951A
❼
0.1 V/DIV
200 ns/DIV
MH952A
❼
0.2 V/DIV
200 ns/DIV
MH958A/MH968A
❼
50 mV/DIV
200 ns/DIV
NO
Repair
Q1, Q2 faulty; replace.
Note: Q2 is amplifier for MH952A only.
YES
C


C
Reconnect long fiber (about 1 km) to OUTPUT and set OUTPUT ON/OFF to ON.
Waveform at ⑧ as shown below?
MH951A
⑧
1 V/DIV
2 µs/DIV
MH952A
⑧
1 V/DIV
2 µs/DIV
MH958A/MH968A
⑧
1 V/DIV
2 µs/DIV
NO
Repair
Q3, Q4, Q5 faulty; replace. MW920A-A4 A/D
(Refer to MW920A service manual.)
YES
END

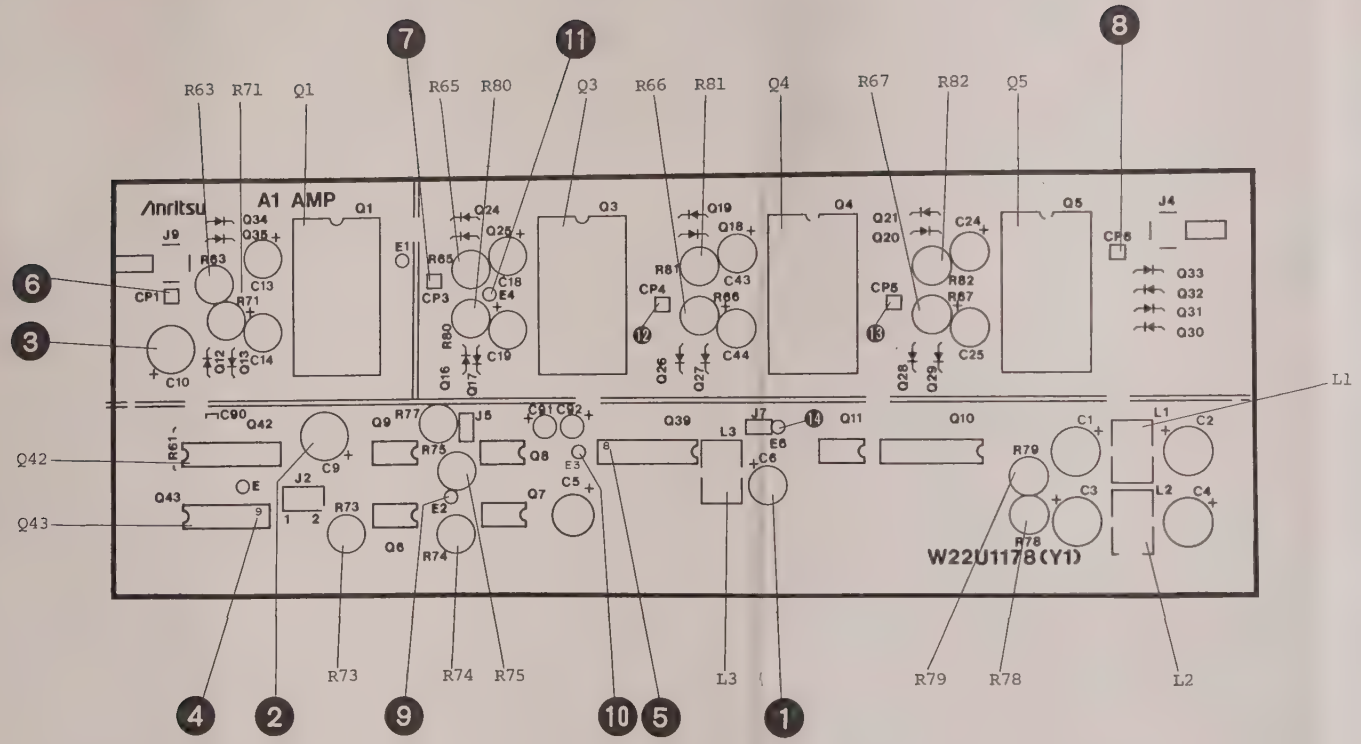


Fig. 3-4 Al AMP PC Board
Parts Layout-Front Side
(MH951A) 2

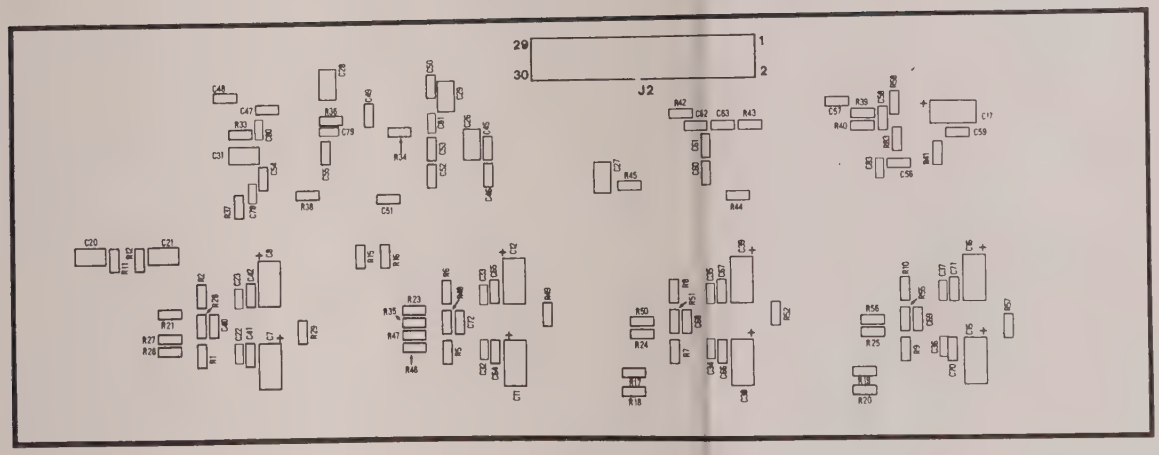


Fig. 3-5 A1 AMP PC Board
Parts Layout-Rear Side
(MH951A) 2

(3-27 blank)/3-28

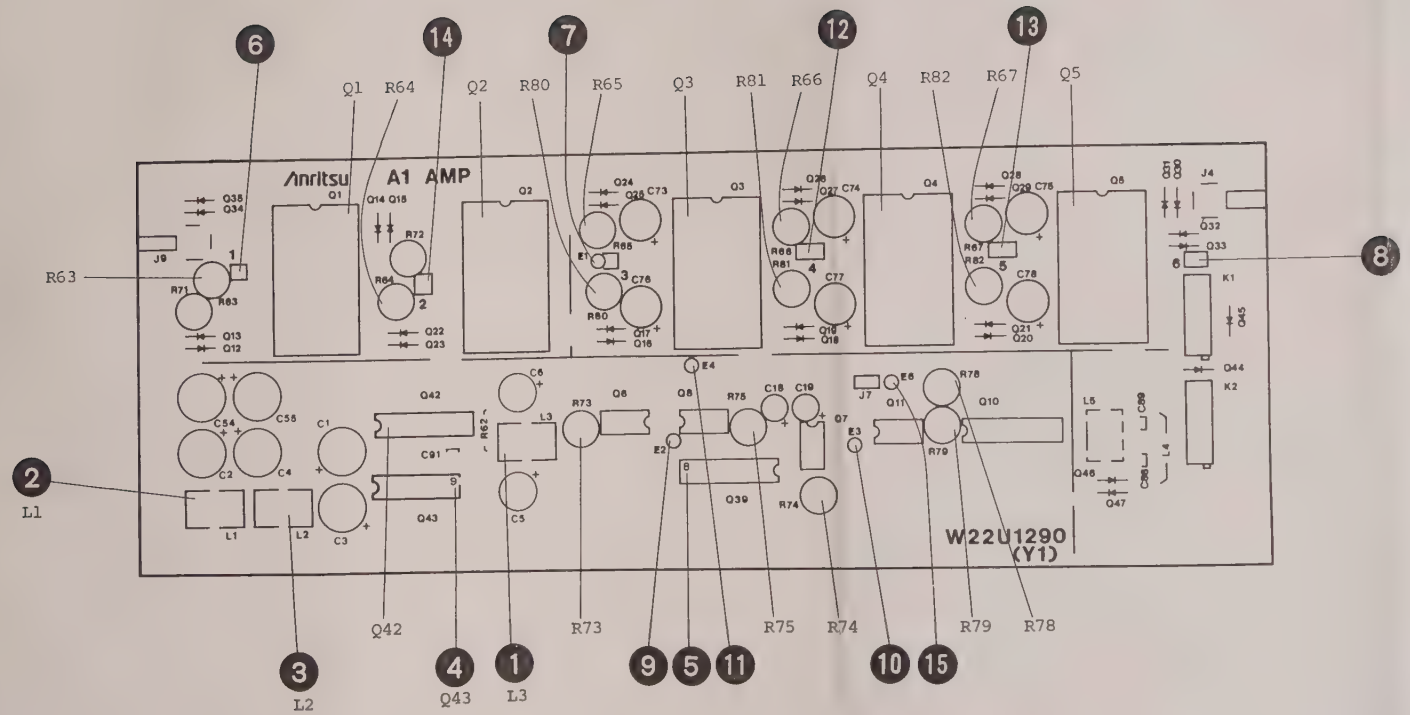


Fig. 3-6 A1 AMP PC Board
Parts Layout-Front Side
(MH952A) 2

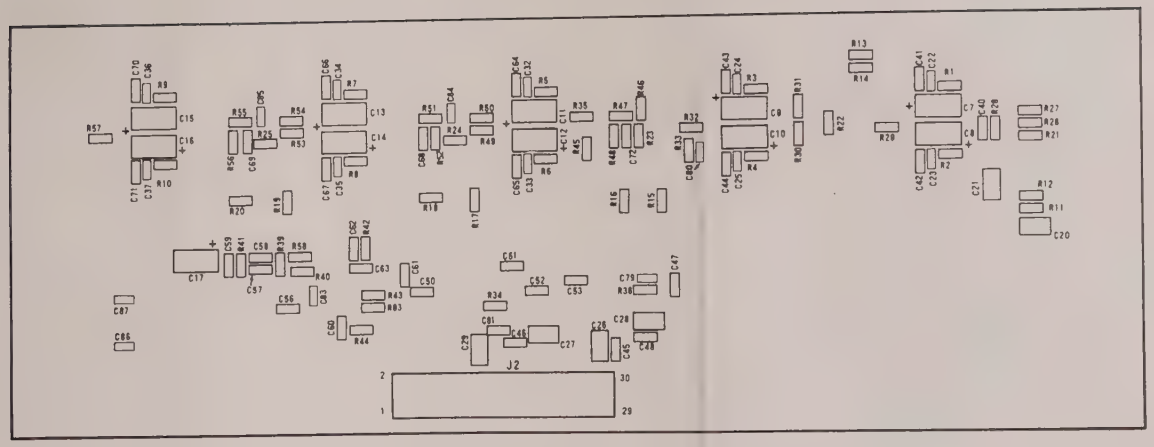


Fig. 3-7 A1 AMP PC Board
Parts Layout-Rear Side
(MH952A) 2

(3-31 blank)/3-32

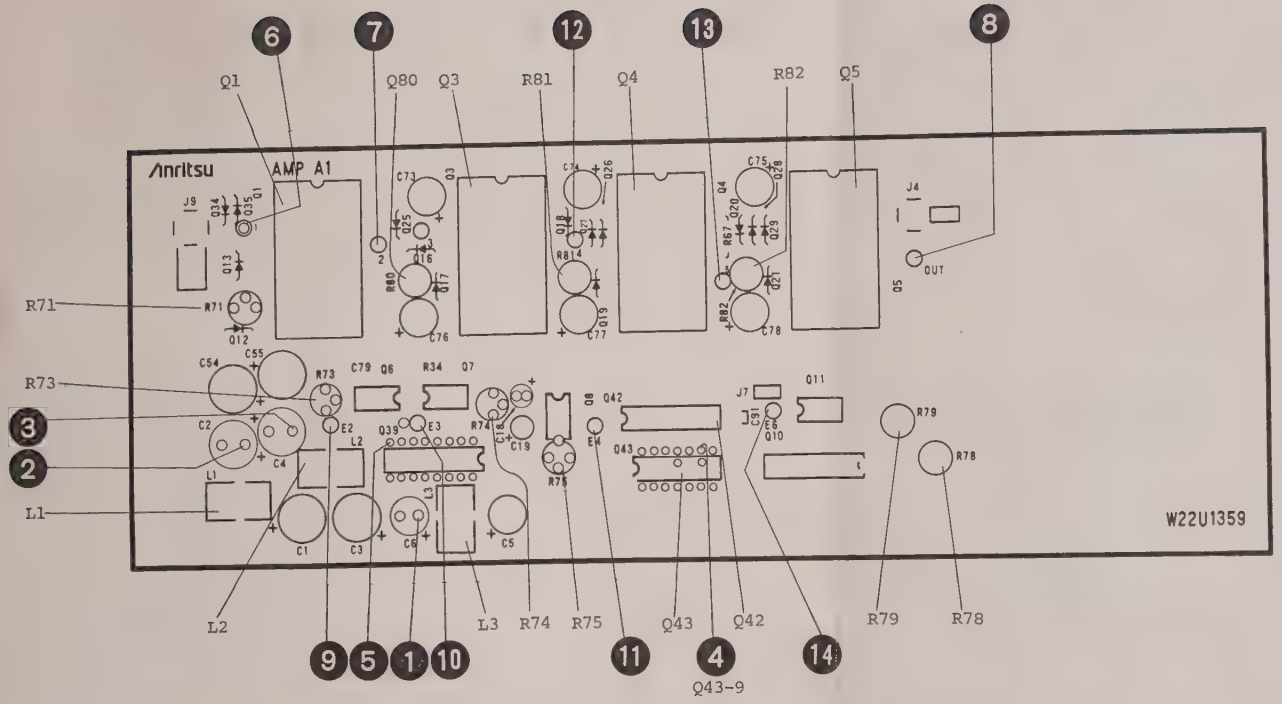


Fig. 3-8 A1 AMP PC Board
Parts Layout-Front Side
(MH958A/MH968A) 2

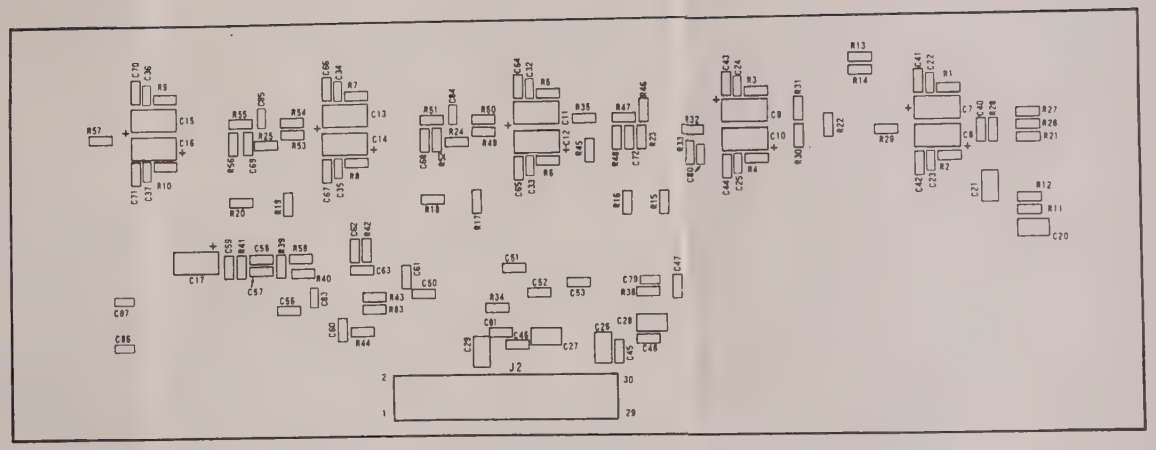
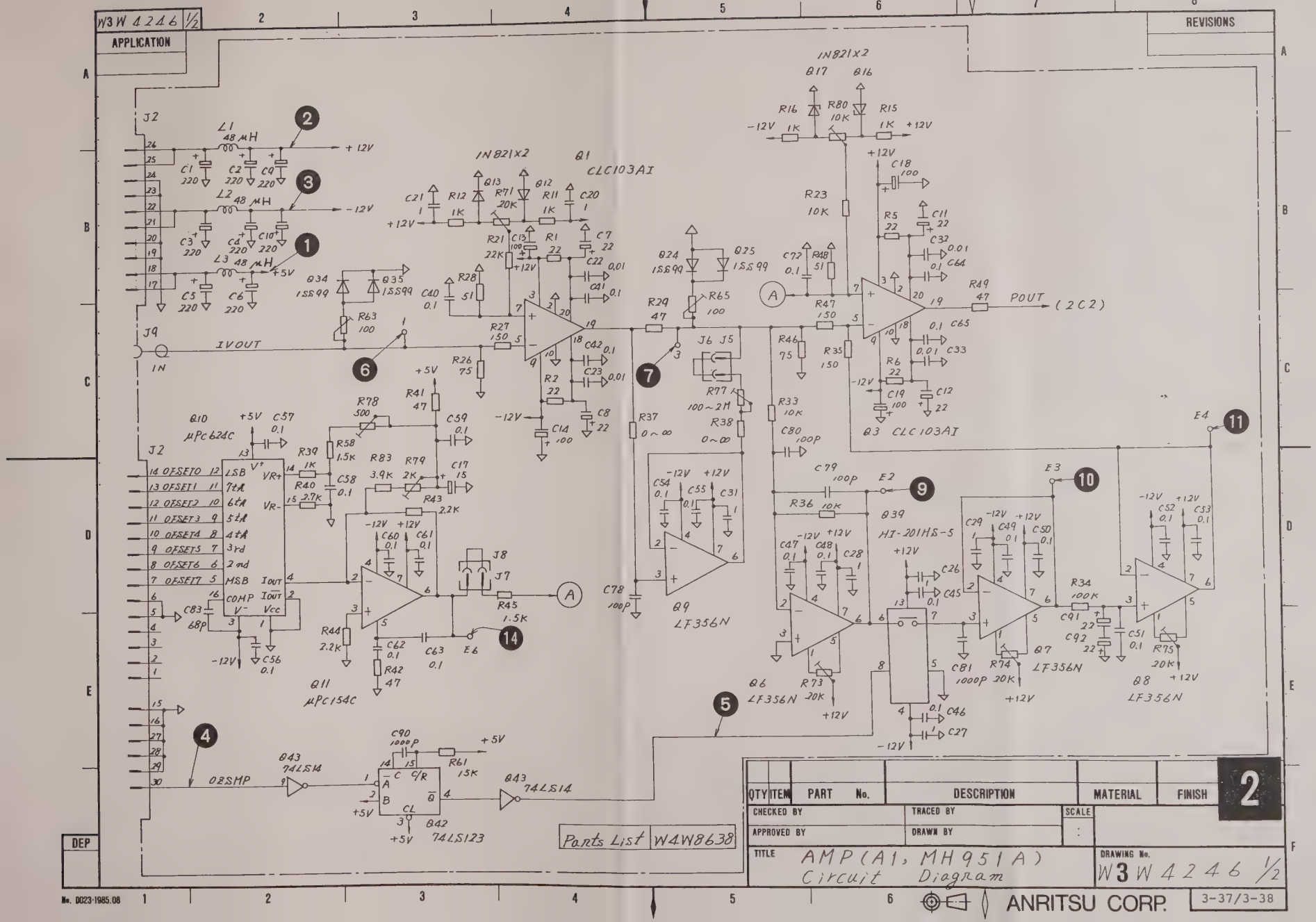


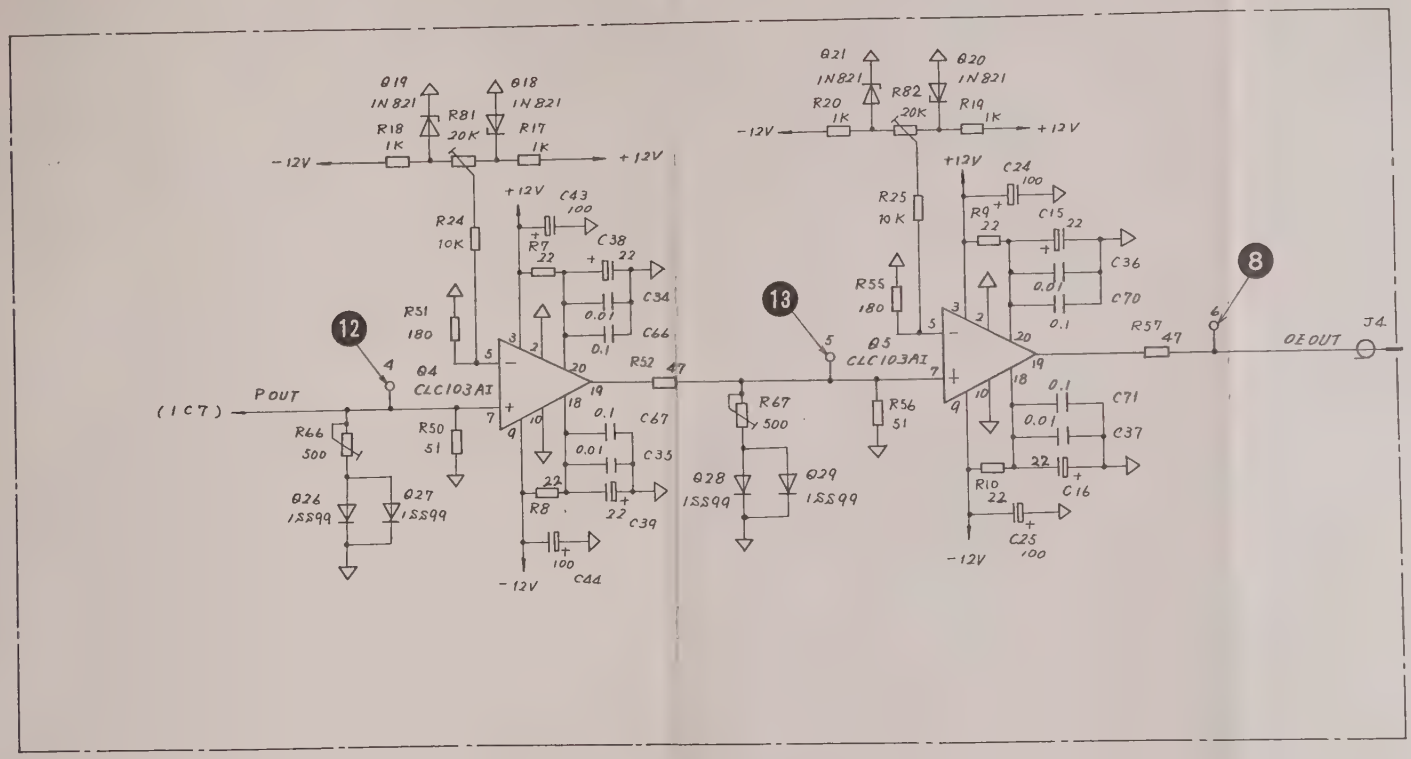
Fig. 3-9 A1 AMP PC Board
Parts Layout-Rear Side
(MH958A/MH968A) 2


W3W4246 1/2
APPLICATION
REVISIONS
J2
L1 48 μH
L2 48 μH
L3 48 μH
+12V
-12V
+5V
C1 220
C2 220
C9 220
C3 220
C4 220
C10 220
C5 220
C6 220
J9
IVOUT
IN
IN821X2
Q17
Q16
R16 1K
R80 10K
R15 1K
Q1 CLC103AI
Q13
Q12
R71 20K
R12 1K
R11 1K
C21 1
C20 1
R21 22K
C13 100
R1 22
C7 22
C22 0.01
C41 0.1
Q34 1SS99
Q35 1SS99
R63 100
C40 0.1
R28 51
R27 150
C42 0.1
C23 0.01
R26 75
R2 22
C8 22
C14 100
Q24 1SS99
Q25 1SS99
R65 100
R29 47
R23 10K
C18 100
R5 22
C11 22
C32 0.01
C64 0.1
C72 0.1
R48 51
R49 47
POUT (2C2)
R47 150
R46 75
R35 150
C65 0.1
C33 0.01
R6 22
C19 100
C12 22
Q3 CLC103AI
J6 J5
R77 100~2M
R38 0~∞
R37 0~∞
R33 10K
C80 100P
C79 100P
R36 10K
C78 100P
Q9 LF356N
Q10 μPC624C
C57 0.1
R78 500
R41 47
C59 0.1
R58 1.5K
R39 1K
R40 2.7K
C58 0.1
R83 3.9K
R79 2K
C17 15
R43 2.2K
C83 68P
C56 0.1
C60 0.1
C61 0.1
J8
J7
R45 1.5K
R44 2.2K
C62 0.1
C63 0.1
R42 47
E6
Q11 μPC154C
Q39 HI-201HS-5
C29 C49 C50
C47 C48 C28
C26 C45
R34 100K
C91 22
C92 22
C51 0.1
R75 20K
Q8 LF356N
Q7 LF356N
Q6 LF356N
R74 20K
R73 20K
C81 1000P
C46 0.1
C27 0.1
C52 0.1
C53 0.1
E2
E3
E4
Q43 74LS14
C90 1000P
R61 15K
Q42 74LS123
OESMP
Parts List W4W8638
DEP
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY
APPROVED BY
TRACED BY
DRAWN BY
SCALE
TITLE AMP(A1, MH951A) Circuit Diagram
DRAWING No. W3W4246 1/2
ANRITSU CORP.
3-37/3-38
No. 0023-1985.08

W3 W 4246 2/2

APPLICATION

REVISIONS

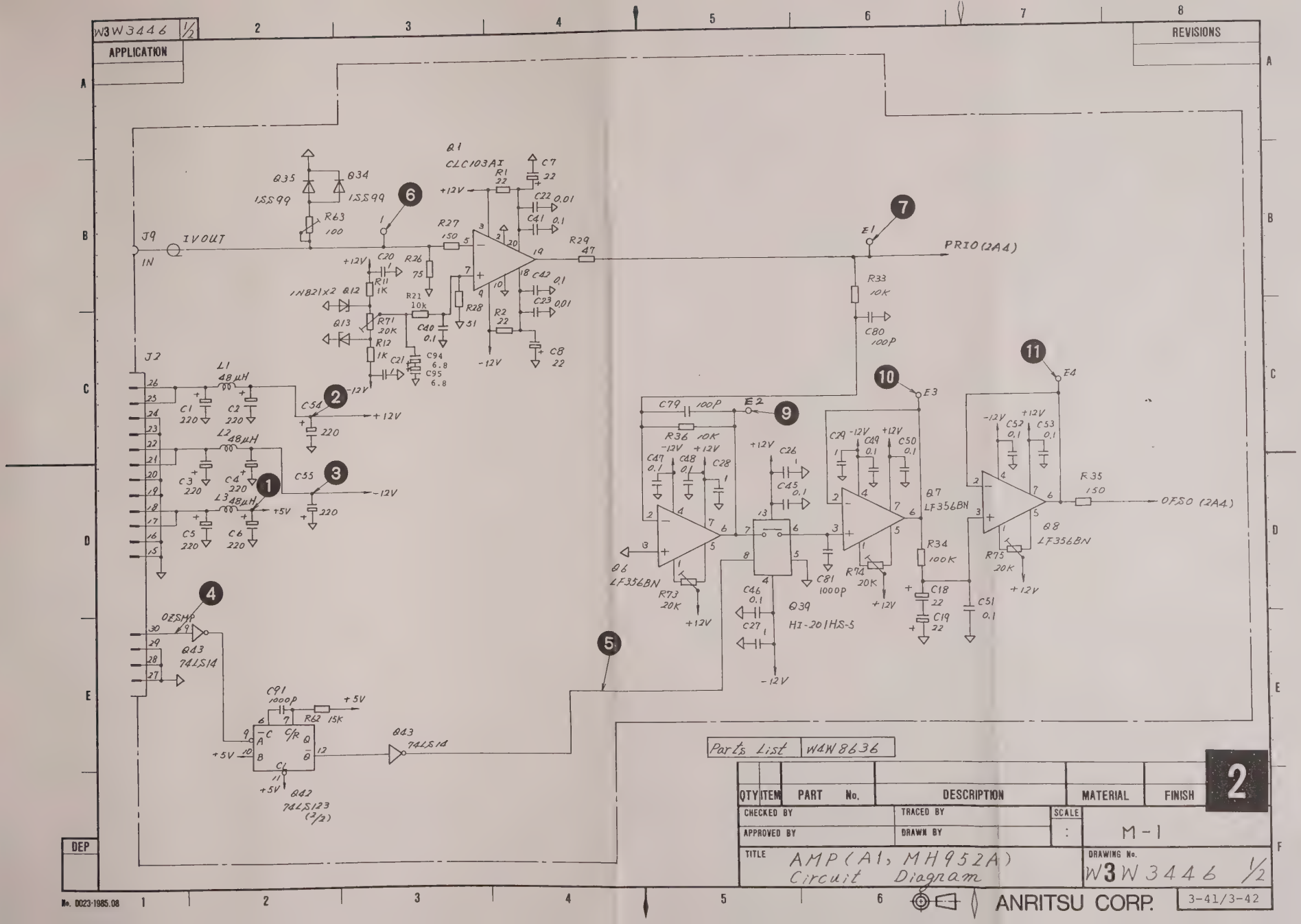


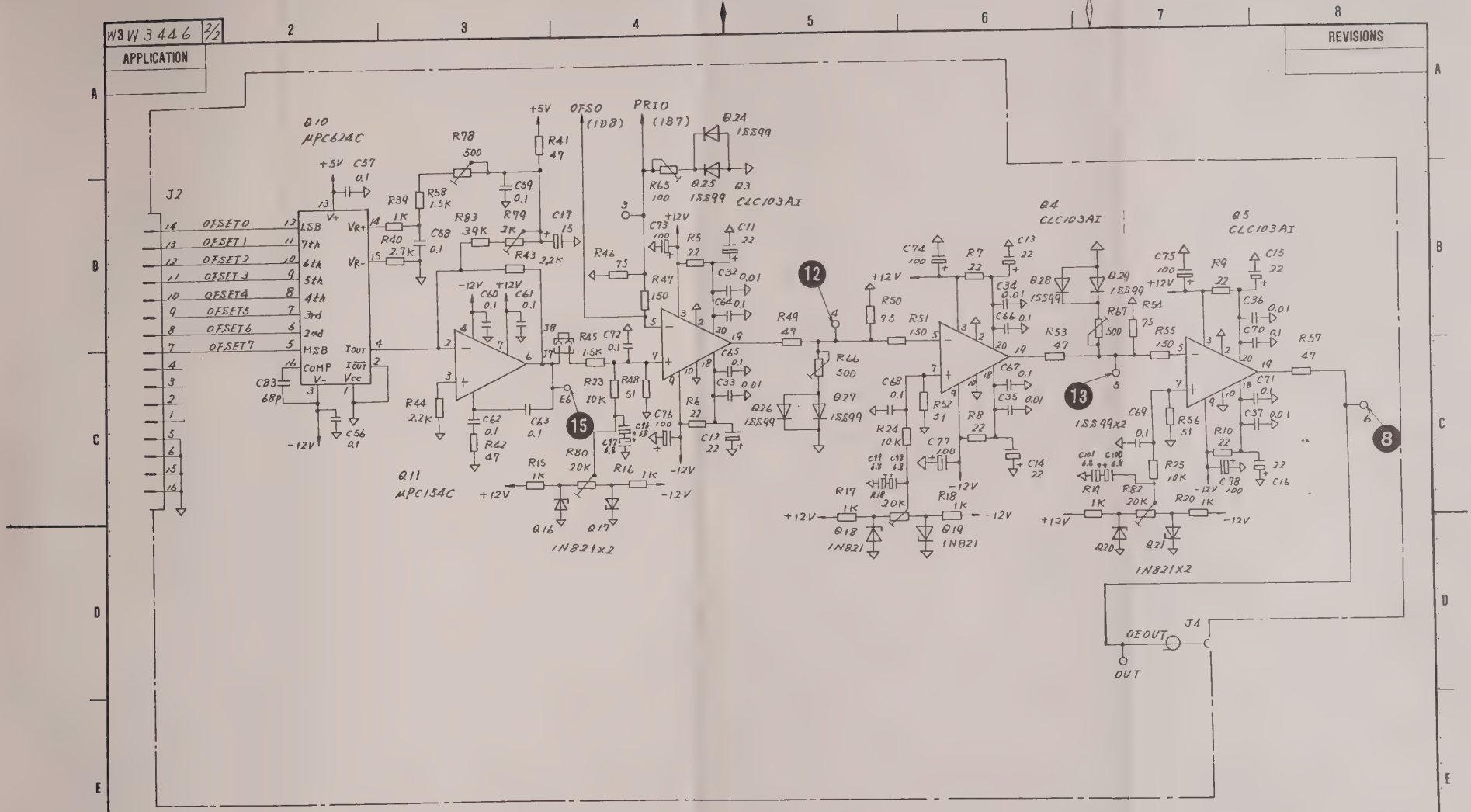
QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH	NOTE
CHECKED BY		TRACED BY		SCALE		
APPROVED BY		DRAWN BY		:		

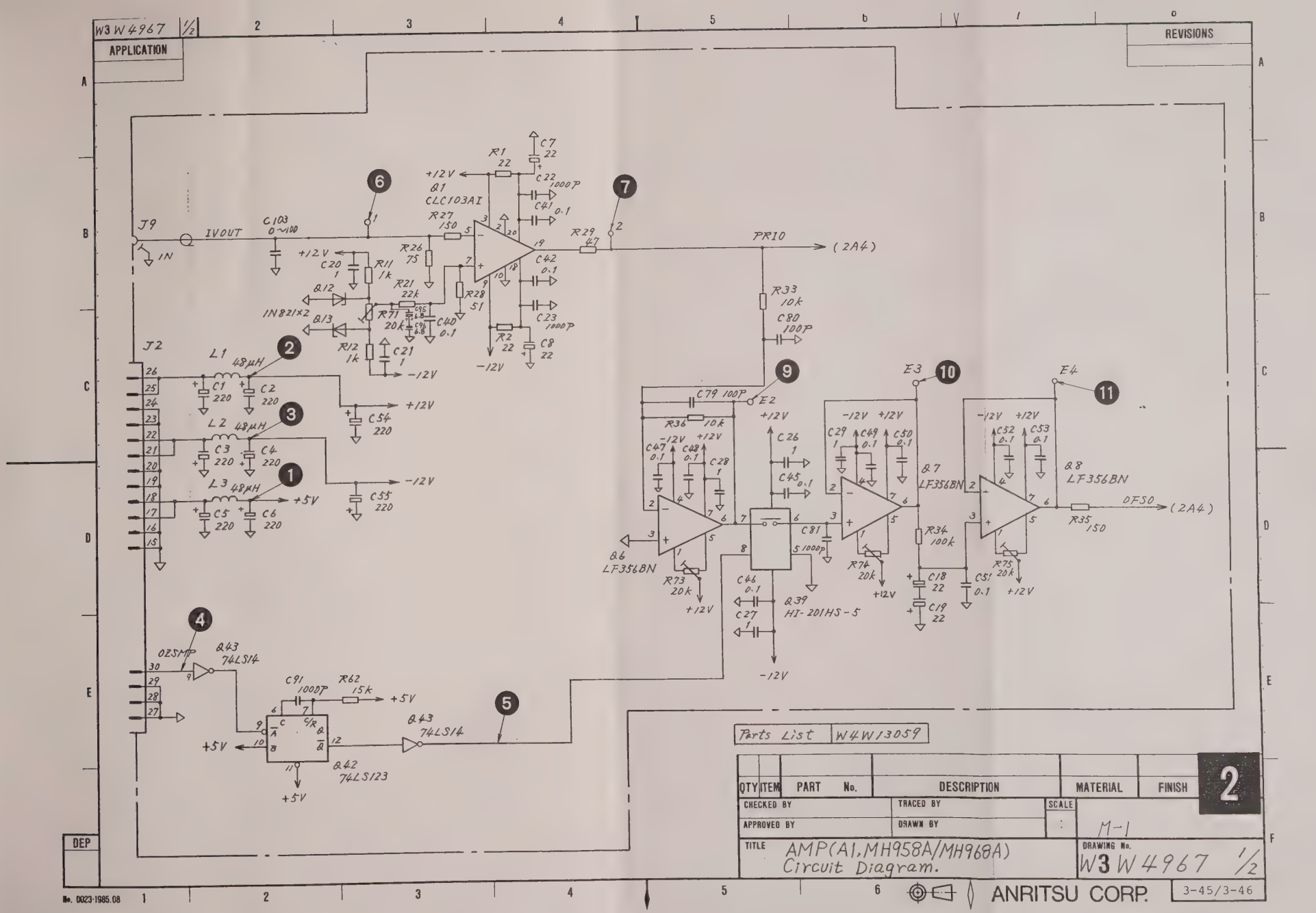
TITLE: AMP (AI, MH951A) Circuit Diagram

DRAWING No.: W3 W 4246 2/2

DEP


W3W3446 1/2
APPLICATION
REVISIONS
IVOUT
IN
J9
J2
Q1
CLC103AI
Q35
Q34
1SS99
1SS99
R63
100
R27
150
R29
47
R1
22
C7
22
C22 0.01
C41 0.1
C20
R26
75
R11
1K
1NB21X2 Q12
Q13
R71
20K
R12
1K
R21
10k
R28
51
C40
0.1
C21
C94 6.8
C95 6.8
R2
22
C42 0.1
C23 0.001
C8
22
+12V
-12V
L1
48μH
L2
48μH
L3
48μH
C1
220
C2
220
C3
220
C4
220
C5
220
C6
220
C54
220
C55
220
+12V
-12V
+5V
E1
PRIO(2A4)
R33
10K
C80
100P
E2
C79
100P
R36
10K
C47
0.1
C48
0.1
C28
C26
1
C45
0.1
Q6
LF356BN
R73
20K
C46
0.1
C27
1
Q39
HI-201HS-5
C81
1000P
E3
C29
C49
0.1
C50
0.1
Q7
LF356BN
R74
20K
R34
100K
C18
22
C19
22
C51
0.1
E4
C52
0.1
C53
0.1
Q8
LF356BN
R75
20K
R35
150
OFSO (2A4)
OESMP
Q43
74LS14
C91
1000P
R62
15K
Q42
74LS123
(1/2)
Q43
74LS14
1
2
3
4
5
6
7
9
10
11
Parts List W4W8636
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
2
CHECKED BY
TRACED BY
SCALE
APPROVED BY
DRAWN BY
:
M-1
TITLE
AMP(A1, MH952A)
Circuit Diagram
DRAWING No.
W3W3446 1/2
DEP
No. 0023-1985.08
ANRITSU CORP.
3-41/3-42

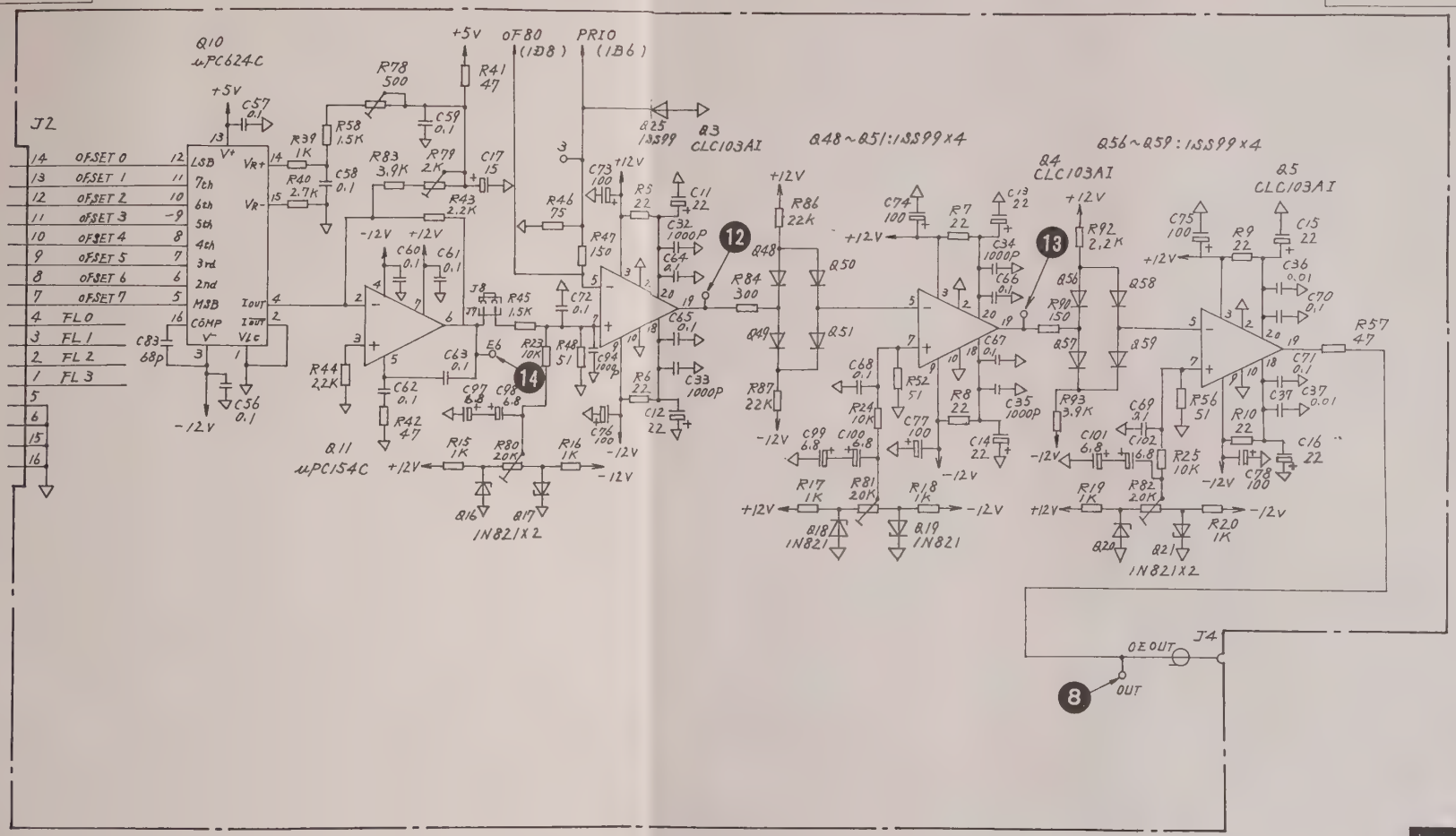

W3W3446 2/2
APPLICATION
REVISIONS
J2
OFSET0
OFSET1
OFSET2
OFSET3
OFSET4
OFSET5
OFSET6
OFSET7
LSB
7th
6th
5th
4th
3rd
2nd
MSB
COMP
Vr+
Vr-
Iout
Iout
Vcc
V+
V-
Q10
μPC624C
Q11
μPC154C
+5V
-12V
+12V
OFSO (188)
PRIO (187)
Q24 1SS99
Q25 1SS99
Q3 CLC103AI
Q4 CLC103AI
Q5 CLC103AI
Q26 1SS99
Q27 1SS99
Q28 1SS99
Q29 1SS99
1SS99x2
Q16
Q17
1N821x2
Q18 1N821
Q19 1N821
Q20
Q21
1N821x2
J4
OEOUT
OUT
12
13
15
8
DEP
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH NOTE
CHECKED BY
TRACED BY
APPROVED BY
DRAWN BY
SCALE
M-1
TITLE AMP (A1, MH952A) Circuit Diagram
DRAWING No. W3W3446 2/2
ANRITSU CORP.
3-43/3-44
No. 0023-1985.08


W3 W4967 1/2
APPLICATION
REVISIONS
J9
IN
IVOUT
C103 0~100
+12V
-12V
+5V
Q1 CLC103AI
R1 22
C7 22
C22 1000P
C41 0.1
R27 150
R26 75
R28 51
R29 47
C42 0.1
C23 1000P
C8 22
R2 22
C20 1
R11 1k
R21 22k
R71 20k
C40 0.1
Q12
Q13
IN821×2
R12 1k
C21 1
PRIO
(2A4)
R33 10k
C80 100P
J2
L1 48μH
L2 48μH
L3 48μH
C1 220
C2 220
C3 220
C4 220
C5 220
C6 220
C54 220
C55 220
C79 100P
E2
R36 10k
C47 0.1
C48 0.1
C28 1
C26 1
C45 0.1
C81 1000P
C46 0.1
C27 1
Q39 HI-201HS-5
Q6 LF356BN
R73 20k
E3
E4
C29 1
C49 0.1
C50 0.1
Q7 LF356BN
R74 20k
C18 22
C19 22
C51 0.1
C52 0.1
C53 0.1
Q8 LF356BN
R75 20k
R34 100k
R35 150
OFSO
(2A4)
OZSMP
Q43 74LS14
C91 1000P
R62 15k
Q42 74LS123
Q43 74LS14
Parts List W4W13059
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY
APPROVED BY
TRACED BY
DRAWN BY
SCALE : M-1
TITLE AMP(A1,MH958A/MH968A) Circuit Diagram.
DRAWING No. W3W4967 1/2
DEP
No. 0023-1985.08
ANRITSU CORP.
3-45/3-46

W3W4967 2/2

APPLICATION

REVISIONS



2

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH	NOTE
CHECKED BY		TRACED BY		SCALE		
APPROVED BY		DRAWN BY		:		

TITLE AMP(A1, MH958A/MH968A) Circuit Diagram.

DRAWING No. W3W4967 2/2

DEP

No. 0023-1985.08

ANRITSU CORP.

3-47/3-48

3.6.3 A2 RECEIVER 3

(1) Circuit description

This receiver uses an avalanche photodiode (APD) as an optoelectric conversion element. The APD can amplify the input by applying a reverse bias voltage to the anode. The amplification gain is controlled by the APD bias voltage from the A5 CONT & APD.

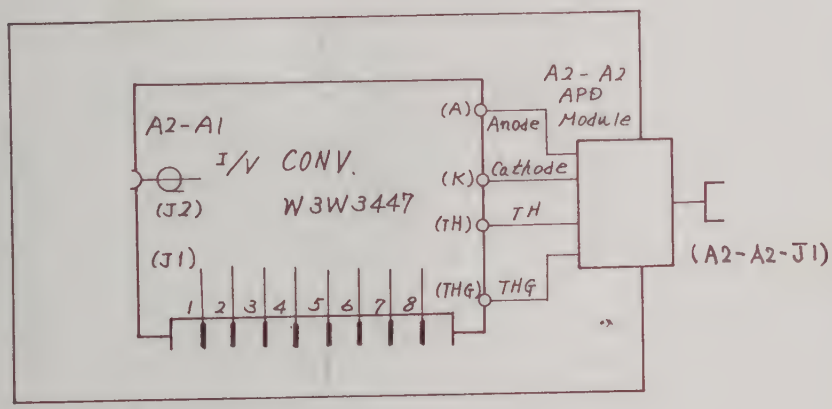
(2) Troubleshooting and repair

Refer to paragraph 3.6.4 for A2-A1 I/V CONV. When the A2-A2 APD module is faulty, and A5 cannot be adjusted correctly by the procedure described in paragraph 4.2.3, replace the A2-A2 unit.

W4W8661 1/1

APPLICATION

REVISIONS



Parts List W4W8642

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

3

CHECKED BY | TRACED BY | SCALE :

APPROVED BY | DRAWN BY

DEP

TITLE RECEIVER (A2, MH951A) Circuit Diagram

DRAWING No. W4W8661 1/1

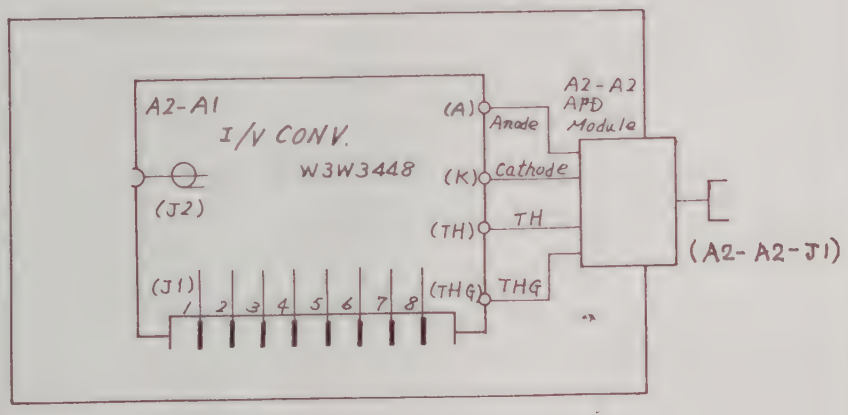
ANRITSU CORP.

3-51/3-52

W4W11071 1/1

APPLICATION

REVISIONS



Parts List W4W11072

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

3

CHECKED BY | TRACED BY | SCALE :

APPROVED BY | DRAWN BY

DEP

TITLE RECEIVER (A2, MH952A) Circuit Diagram

DRAWING No. W4W11071 1/1

No. D025-1985.08

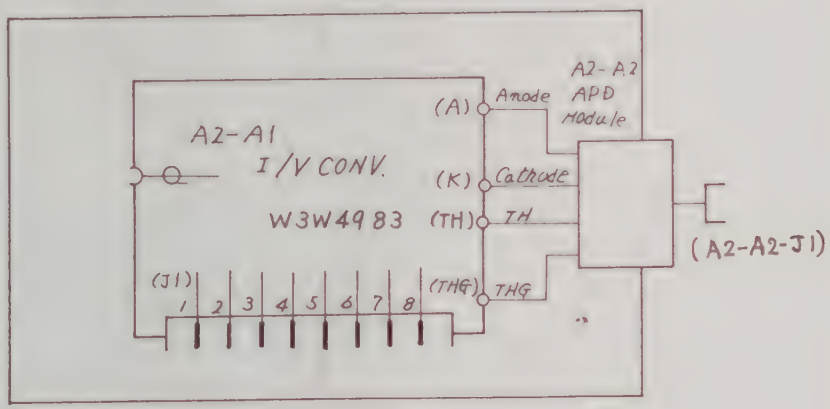
ANRITSU CORP.

3-53/3-54

W4W13071 1/1

APPLICATION

REVISIONS



Parts List | W4W13072

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

3

CHECKED BY | TRACED BY | SCALE :

APPROVED BY | DRAWN BY

DEP

TITLE: RECEIVER (A2, MH958A/MH968A) Circuit Diagram

DRAWING No. W4W13071 1/1

No. 0025-1985.08

ANRITSU CORP.

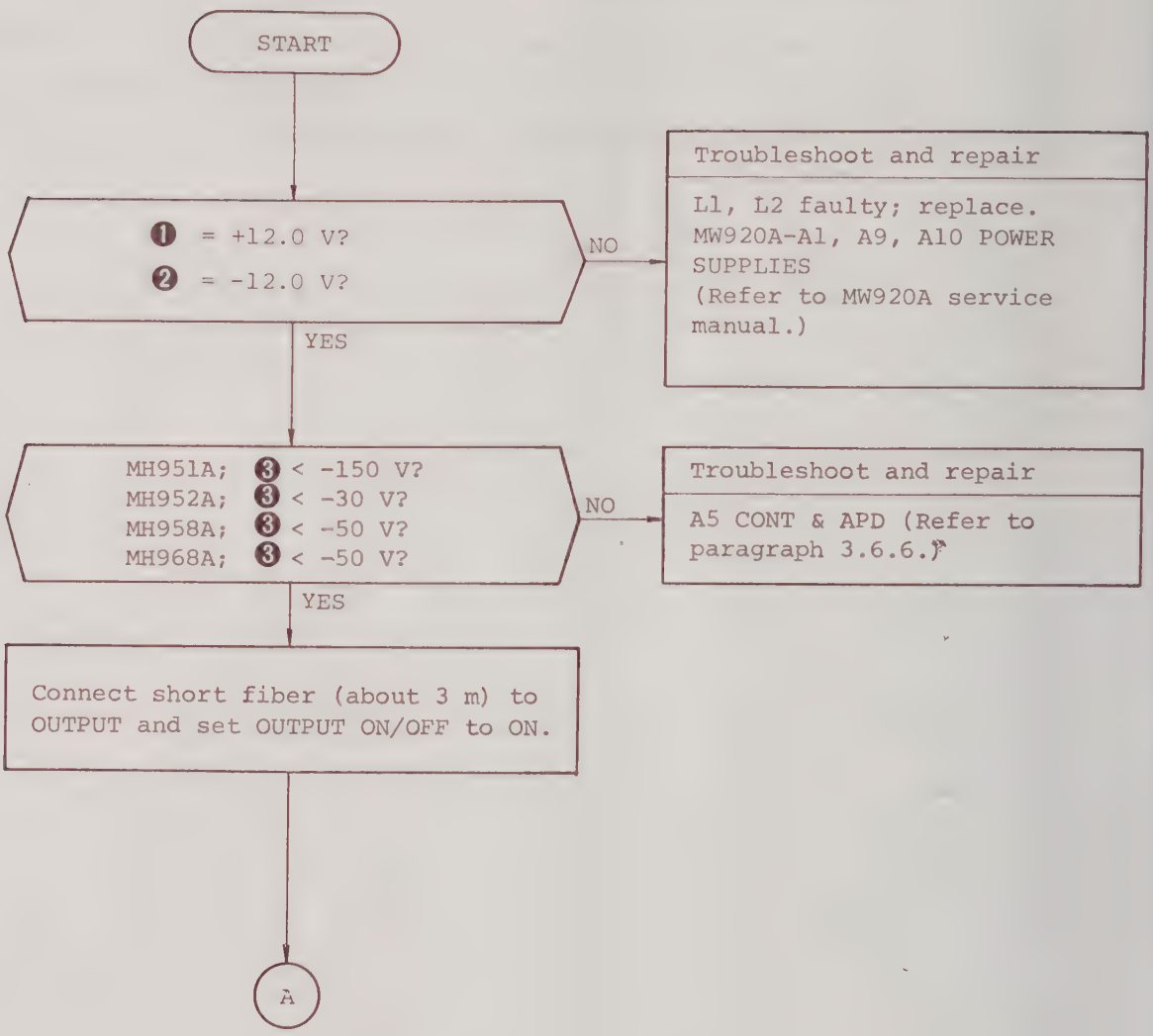
3-55/3-56

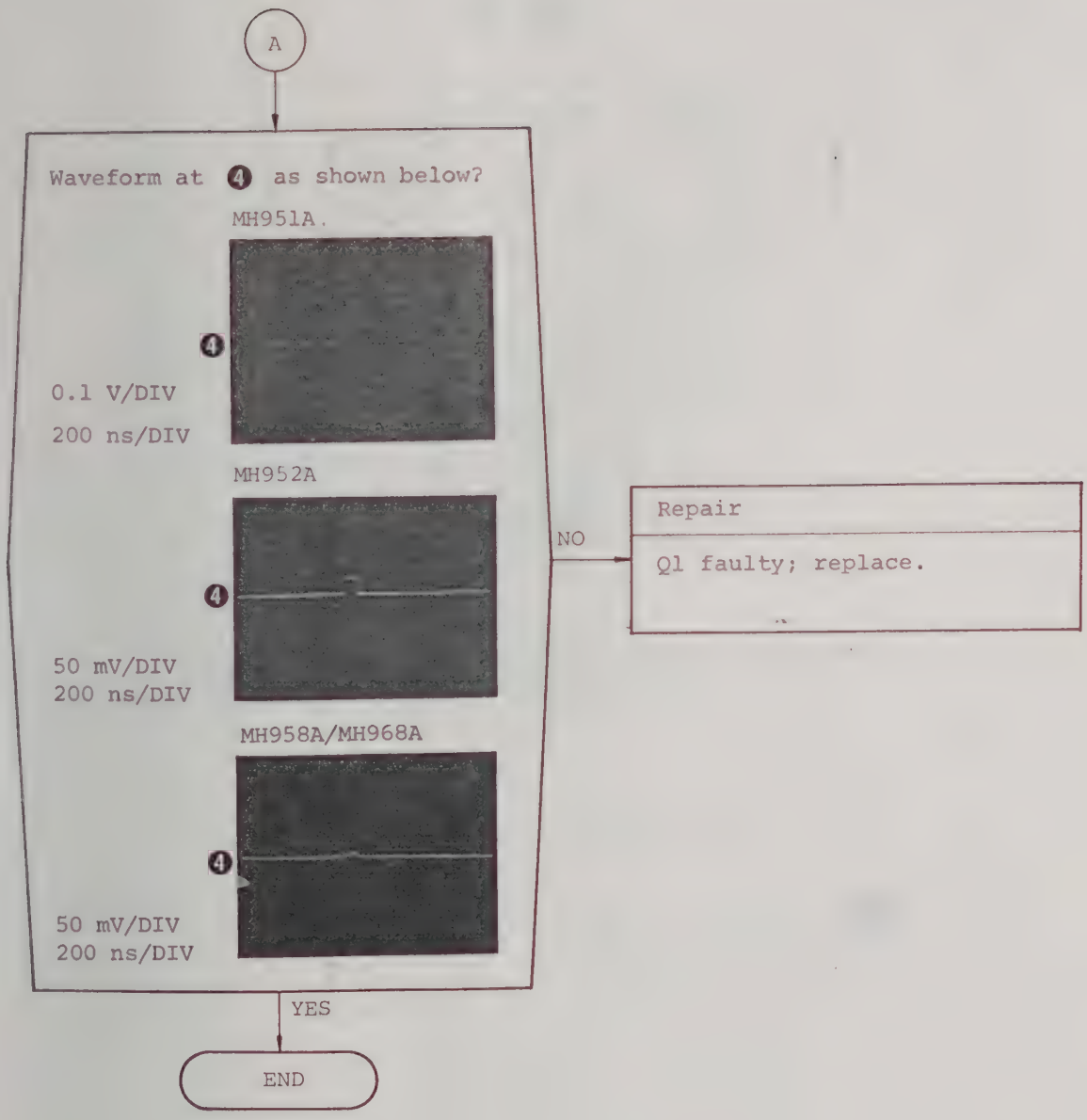
3.6.4 A2-A1 I/V CONV 4

(1) Circuit description

The optical signal that is converted to a current signal by the APD is then converted to voltage by the Q1 operational amplifier and input to A1 AMP.

(2) Troubleshooting and repair


START
❶ = +12.0 V?
❷ = -12.0 V?
NO
Troubleshoot and repair
L1, L2 faulty; replace. MW920A-A1, A9, A10 POWER SUPPLIES (Refer to MW920A service manual.)
YES
MH951A; ❸ < -150 V?
MH952A; ❸ < -30 V?
MH958A; ❸ < -50 V?
MH968A; ❸ < -50 V?
NO
Troubleshoot and repair
A5 CONT & APD (Refer to paragraph 3.6.6.)
YES
Connect short fiber (about 3 m) to OUTPUT and set OUTPUT ON/OFF to ON.
A


A
Waveform at ❹ as shown below?
MH951A.
❹
0.1 V/DIV
200 ns/DIV
MH952A
❹
50 mV/DIV
200 ns/DIV
MH958A/MH968A
❹
50 mV/DIV
200 ns/DIV
NO
Repair
Q1 faulty; replace.
YES
END

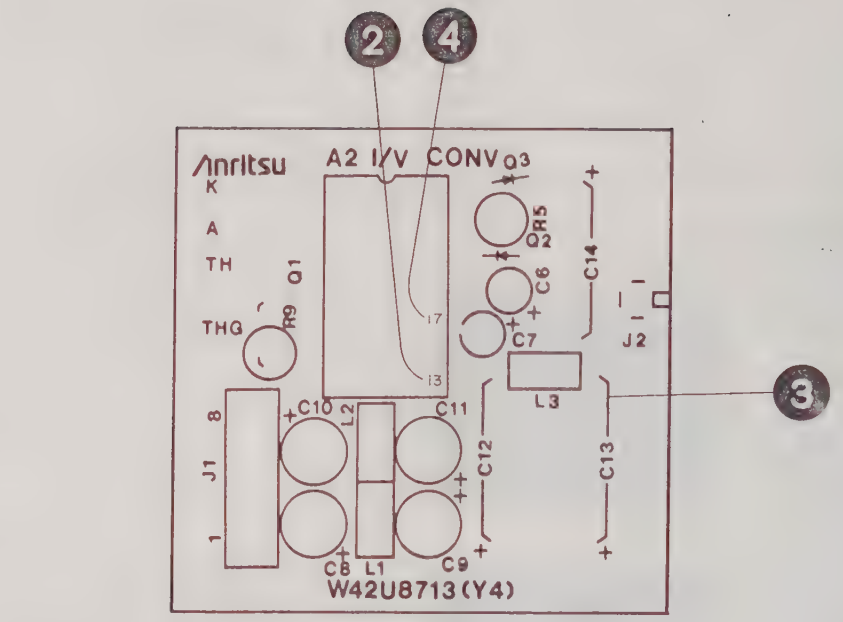


Fig. 3-10 A2-A1 I/V CONV PC Board Parts Layout-Front Side 4

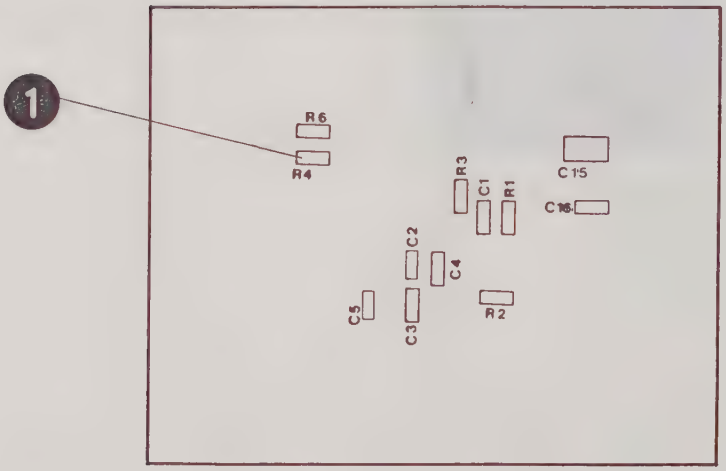
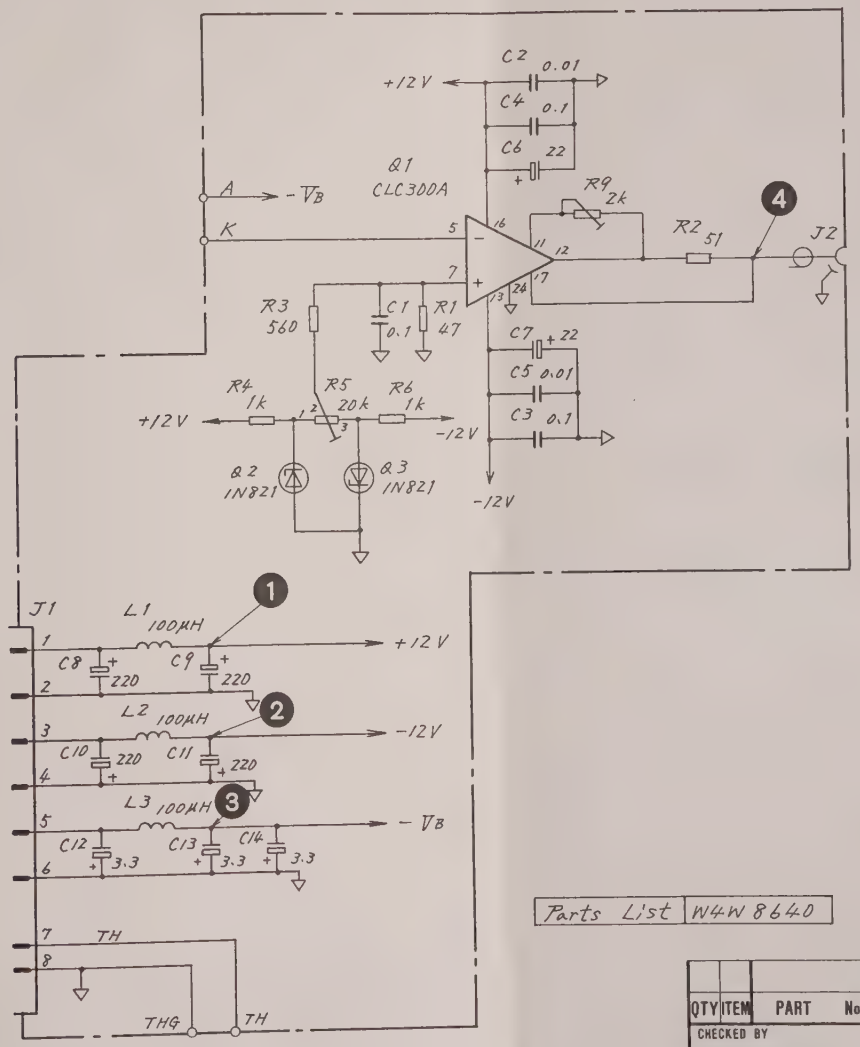


Fig. 3-11 A2-A1 I/V CONV PC Board Parts Layout-Rear Side 4

W3 W3447 1/1

APPLICATION

REVISIONS



Parts List W4W 8640

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

CHECKED BY | TRACED BY | SCALE : M-1

APPROVED BY | DRAWN BY

TITLE I/V CONV. (A2-A1, MH951A) Circuit Diagram.

DRAWING No. W3W3447 1/1

4

DEP

ANRITSU CORP.

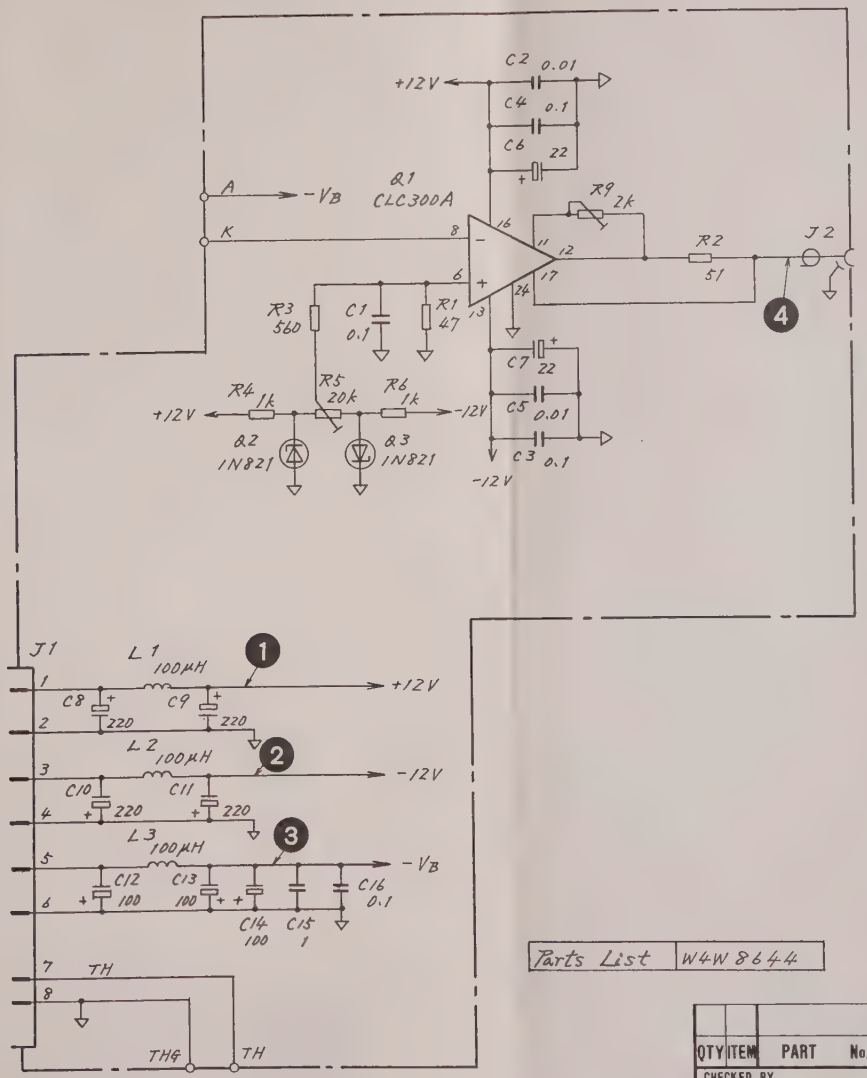
3-61/3-62

No. 0023-1985.08

W3 W 3448 1/1

APPLICATION

REVISIONS



Parts List W4W 8644

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

CHECKED BY | TRACED BY | SCALE

APPROVED BY | DRAWN BY

TITLE I/V CONV. (A2-A1, MH952A) Circuit Diagram.

DRAWING No. W3 W 3448 1/1

DEP

No. 0023-1985.08

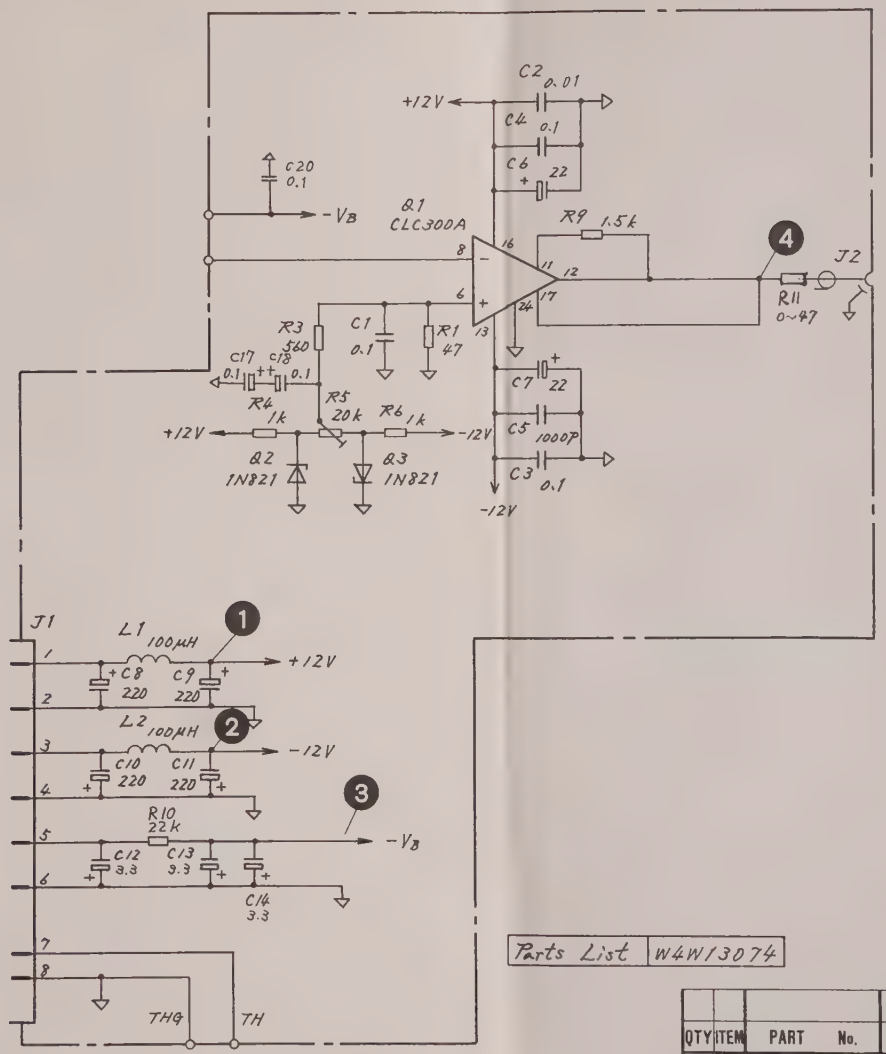
ANRITSU CORP.

3-63/3-64

W3W4983 1/1

APPLICATION

REVISIONS



Parts List W4W13074

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

CHECKED BY | TRACED BY | SCALE

APPROVED BY | DRAWN BY | M-1

TITLE I/V(A2-A1,MH958A/MH968A) Circuit Diagram.

DRAWING No. W3W4983 1/1

4

DEP

No. D023-1985.08

ANRITSU CORP. 3-65/3-66

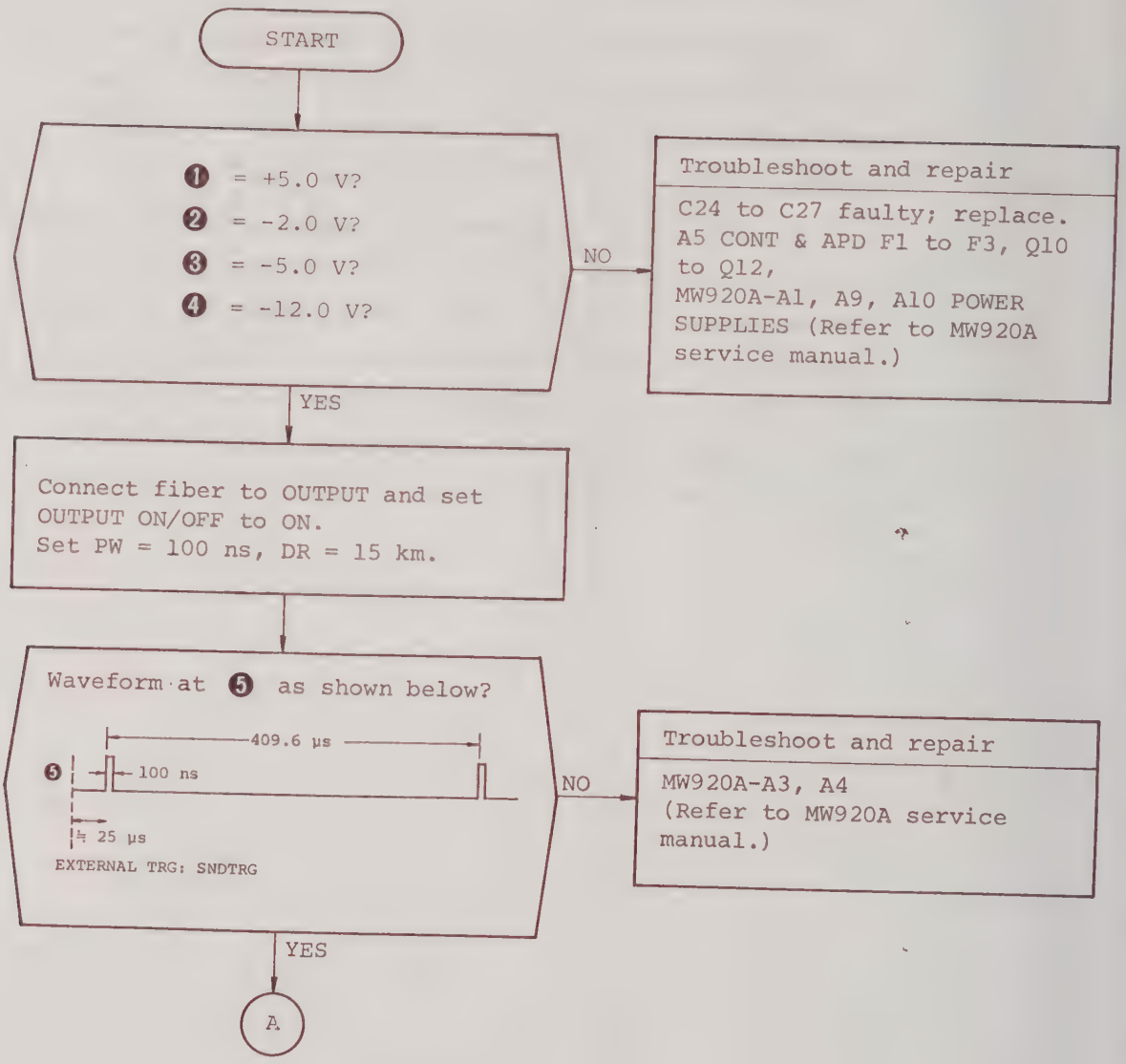
3.6.5 A3 LD DRIVER-2 5

(1) Circuit description

This PC board consists of pulse signal emission timing adjustment circuit to drive the LD, a pulse width selection circuit, a drive current switch circuit, and a waveform shaping circuit.

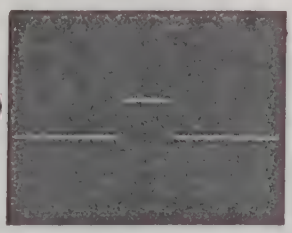
The PC board receives a trigger signal from the MW920A and adjusts the emission timing at Q14. It then converts the signal level from TTL to ECL and generates a predetermined pulse width using Q9 and Q10. The pulse waveform is shaped and amplified by Q5 to Q8. The pulse width and the drive current switchings are controlled by a signal from A5 CONV & APD.

(2) Troubleshooting and repair



A

Waveform at ❻ as shown below?



0.5 V/DIV
200 ns/DIV

NO → **Repair**

Q13, Q14, Q15 faulty; replace.

YES

Voltage level at ❼ and ❽ change according to Table 3-6 when pulse width setting changed with [PULSE] key?

Table 3-6 Levels at ❼ / ❽ and Pulsewidth

P.W. \ No.	❽	❼
100 ns	H	H
10 ns	L	H
3 ns	L	L

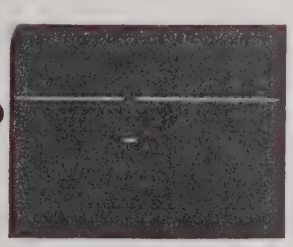
Level: ECL level

NO → **Troubleshoot and repair**

A5 CONT & APD (Refer to paragraph 3.6.6.)

YES

Waveform at ❾ as shown below?



0.5 V/DIV
200 ns/DIV

NO → **Repair**

Q9, Q10 faulty; replace.

YES

B

B

Waveform at ⑩ and ⑪ as shown below?

0.5 V/DIV
200 ns/DIV

NO

Troubleshoot and repair

A5 CONT & APD (Refer to paragraph 3.6.6.)

YES

Voltage level at 12 and 13 (MH958A/MH968A only) change according to Table 3-7 when ATT setting changed with [ADV FUNCTION] key?

Table 3-7 Levels at ⑫/⑬ and ATT setting

MH951A/MH952A

ATT \ No.	⑫
ATT OFF	L
ATT ON	H

MH958A/MH968A

ATT \ No.	⑬	⑫
ATT OFF	L	L
ATT L	L	H
ATT M	H	L
ATT H	H	H

Level: High (H) ≥-11.3 V
Low (L) <-11.3 V

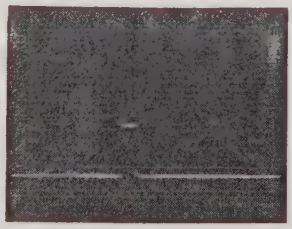
NO

Troubleshoot and repair

A5 CONT & APD
(Refer to paragraph 3.6.6.)

YES

Waveform at ⑭ as shown below?



2 V/DIV
200 ns/DIV

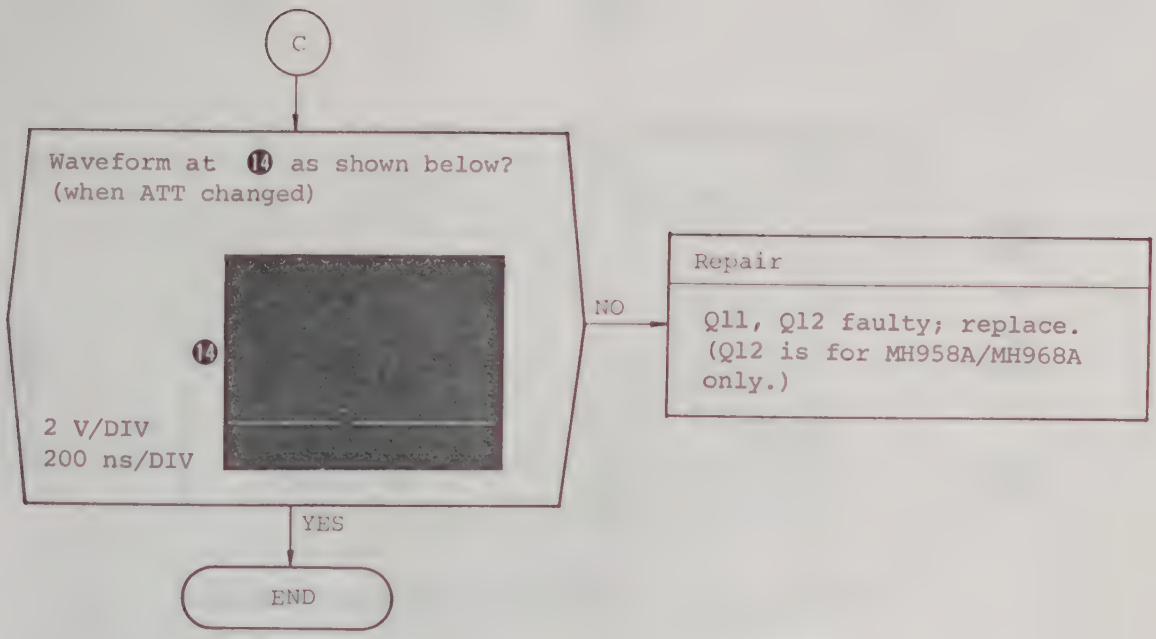
NO

Repair

Q5, Q6 faulty; replace.

YES

C


C
Waveform at ⓮ as shown below?
(when ATT changed)
⓮
2 V/DIV
200 ns/DIV
NO
Repair
Q11, Q12 faulty; replace.
(Q12 is for MH958A/MH968A
only.)
YES
END

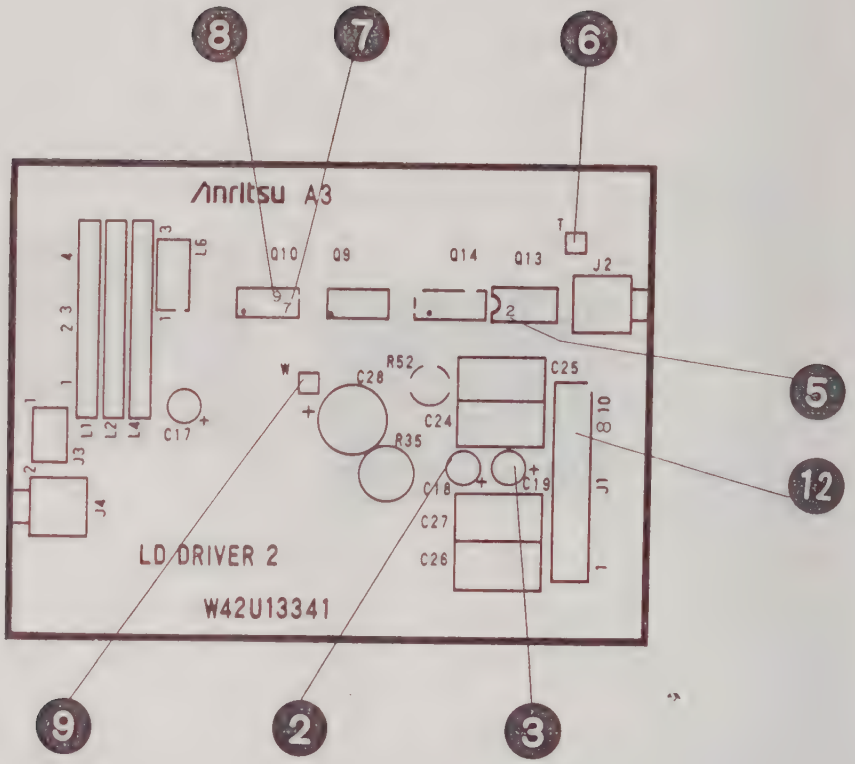


Fig. 3-12 A3 LD DRIVER-2 PC Board Parts Layout-Front Side (MH951A, MH952A) 5

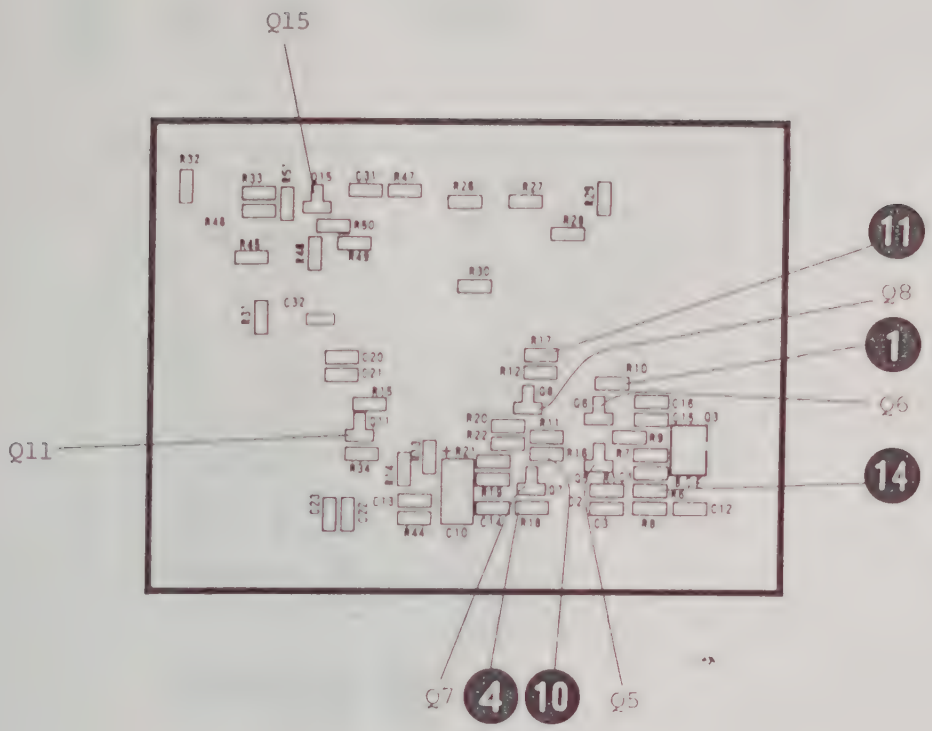


Fig. 3-13 A3 LD DRIVER-2 PC Board Parts Layout-Rear Side (MH951A, MH952A) 5

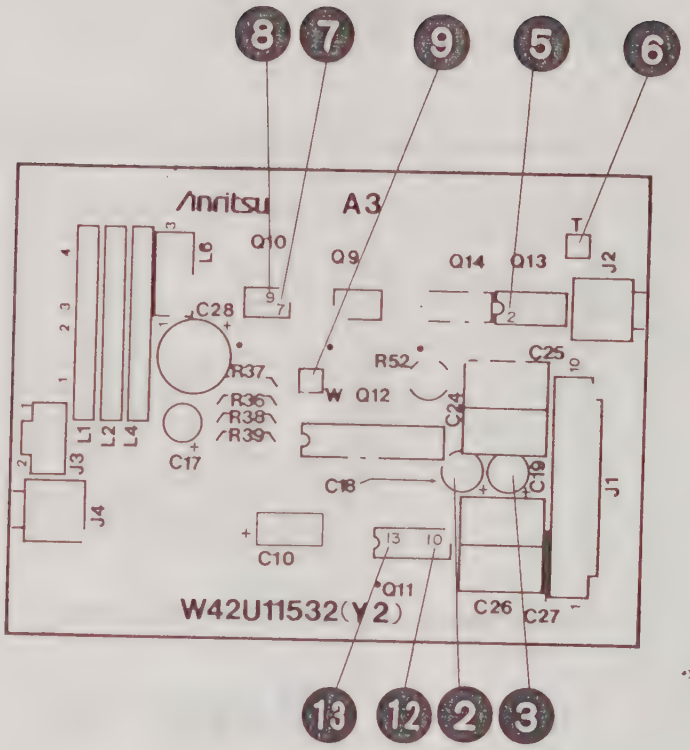


Fig. 3-14 A3 LD DRIVER-2 PC Board Parts Layout-Front Side (MH958A/MH968A) 5

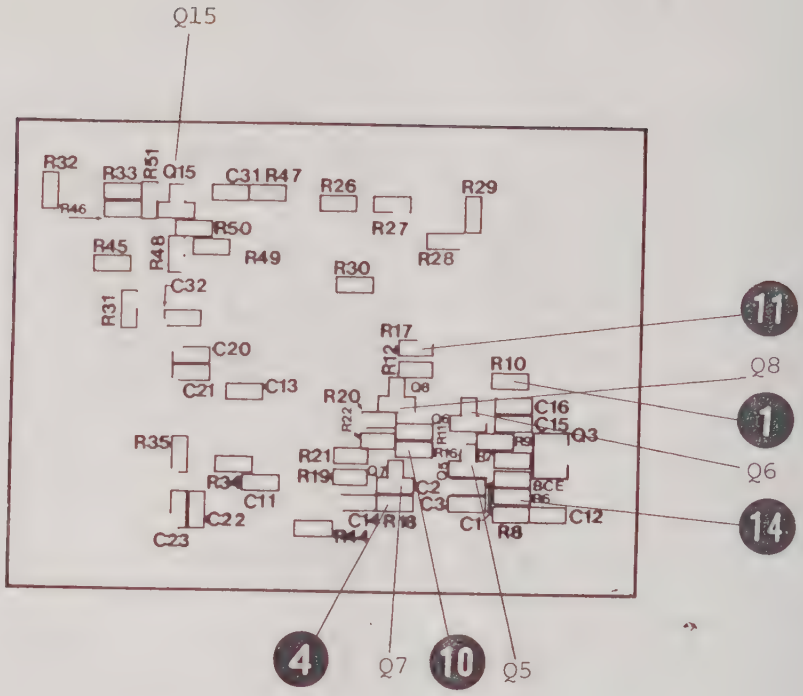
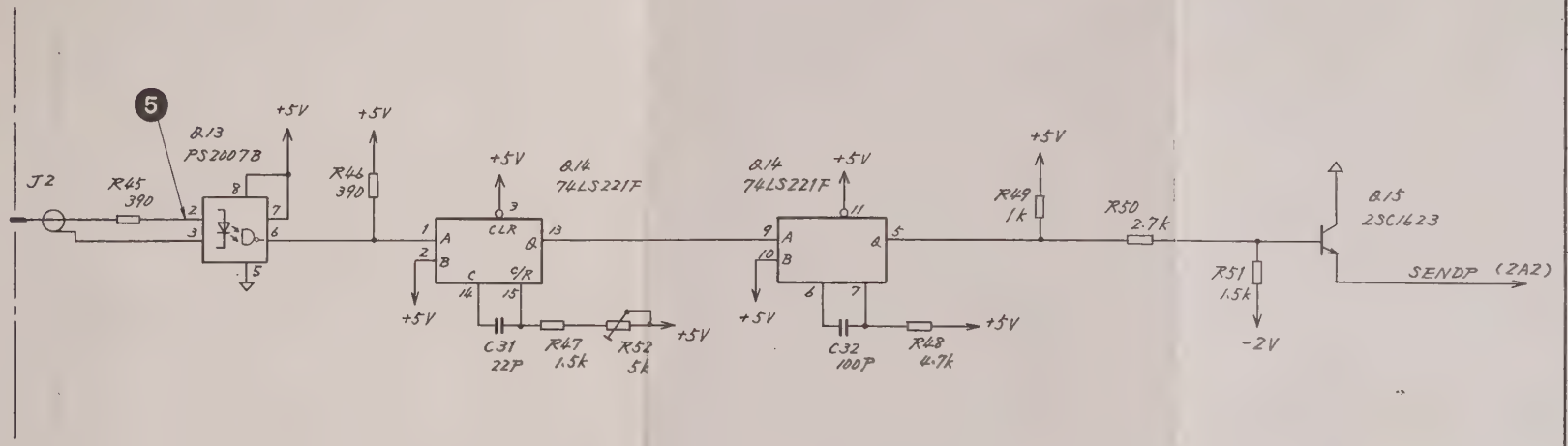


Fig. 3-15 A3 LD DRIVER-2 PC Board
Parts Layout-Rear Side
(MH958A/MH968A) 5

W3W4646 1/2

APPLICATION

REVISIONS



Parts List | W4W12091

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

CHECKED BY | TRACED BY | SCALE

APPROVED BY | DRAWN BY | :

TITLE: LD DRIVE-2 (A3, MH951A/MH952A) Circuit Diagram.

DRAWING No. W3W4646 1/2

DEP

5

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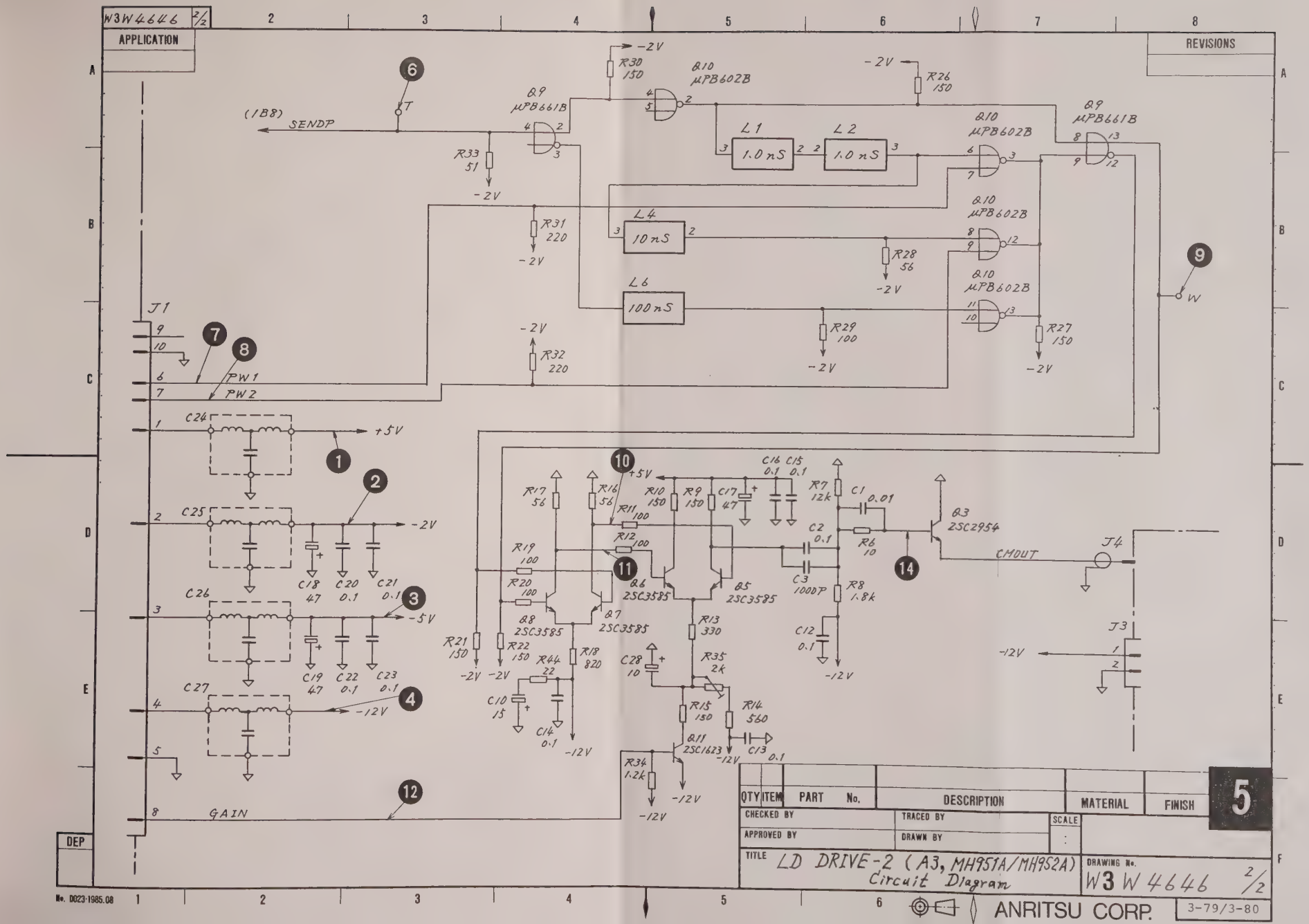
3-77/3-78

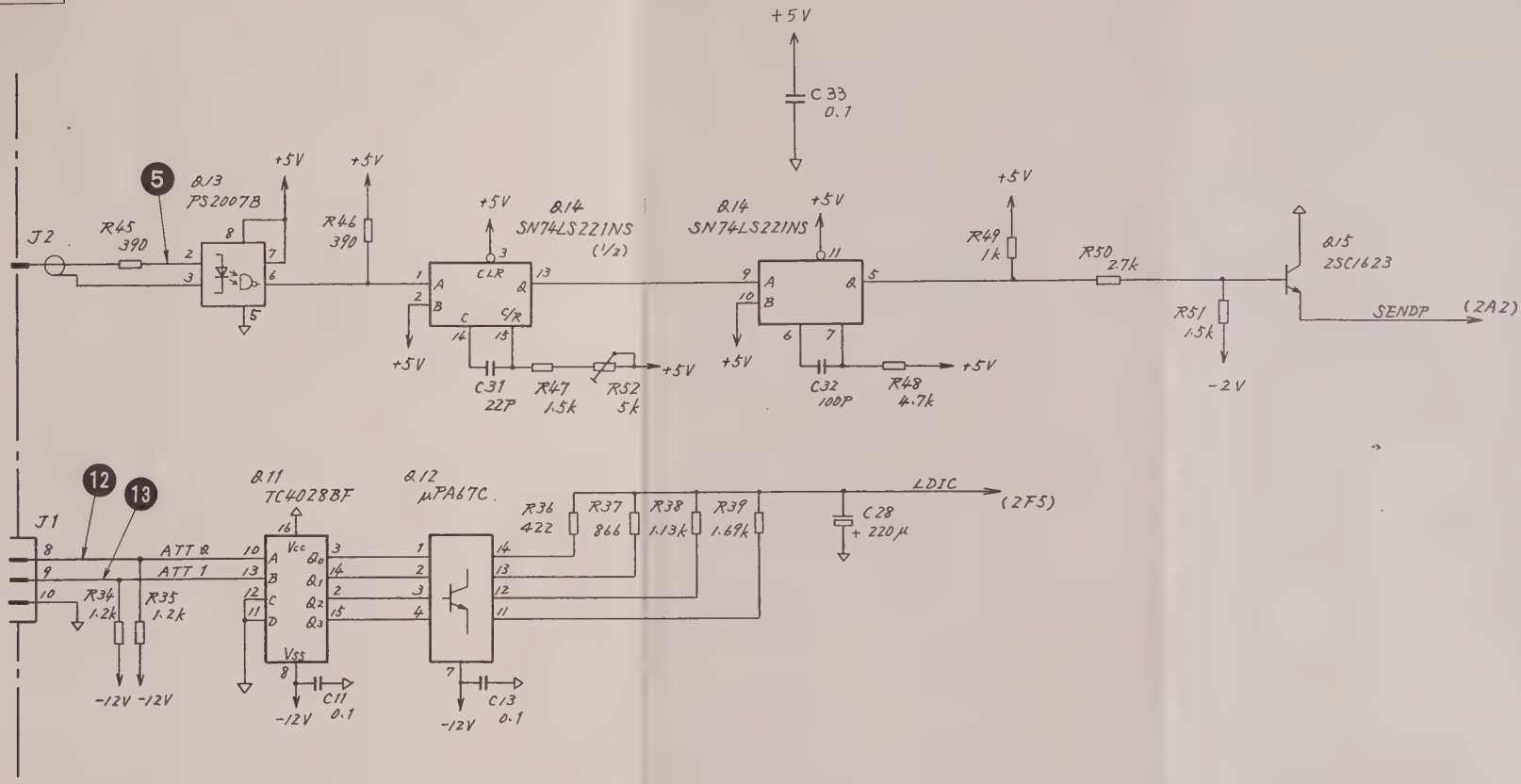
No. 0023-1985.08


W3W4646 2/2
APPLICATION
REVISIONS
(1B8) SENDP
T
-2V
R30 150
Q10 μPB602B
R26 150
Q9 μPB661B
L1 1.0nS
L2 1.0nS
R33 51
R31 220
L4 10nS
R28 56
L6 100nS
R29 100
R27 150
R32 220
W
J1
PW1
PW2
+5V
-5V
-12V
C24
C25
C26
C27
C18 47
C20 0.1
C21 0.1
C19 47
C22 0.1
C23 0.1
GAIN
R17 56
R16 56
R11 100
R10 150
R9 150
C17 47
C16 C15 0.1
R7 12k
C1 0.01
R12 100
R19 100
R20 100
C2 0.1
R6 10
Q3 2SC2954
Q6 2SC3585
Q5 2SC3585
Q7 2SC3585
Q8 2SC3585
C3 1000P
R8 1.8k
C12 0.1
R13 330
R35 2k
R21 150
R22 150
R44 22
R18 820
C28 10
C10 15
C14 0.1
R15 150
R14 560
C13 0.1
Q11 2SC1623
R34 1.2k
CMOUT
J4
J3
DEP
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY
APPROVED BY
TRACED BY
DRAWN BY
SCALE
TITLE LD DRIVE-2 (A3, MH951A/MH952A) Circuit Diagram
DRAWING No. W3W4646 2/2
5
No. 0023-1985.08
ANRITSU CORP.
3-79/3-80

W3 W4367 1/2

APPLICATION

REVISIONS



ATT 1	ATT 0.	ILD
0	0	400 mA
0	1	160 mA
1	0	120 mA
1	1	80 mA

Parts List	W4W11078

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

CHECKED BY | TRACED BY | SCALE

APPROVED BY | DRAWN BY

TITLE LD DRIVE-2 (A3, MH958A/MH968A) Circuit Diagram.

DRAWING No. W3 W4367 1/2

5

DEP

No. 0023-1985.08

ANRITSU CORP.

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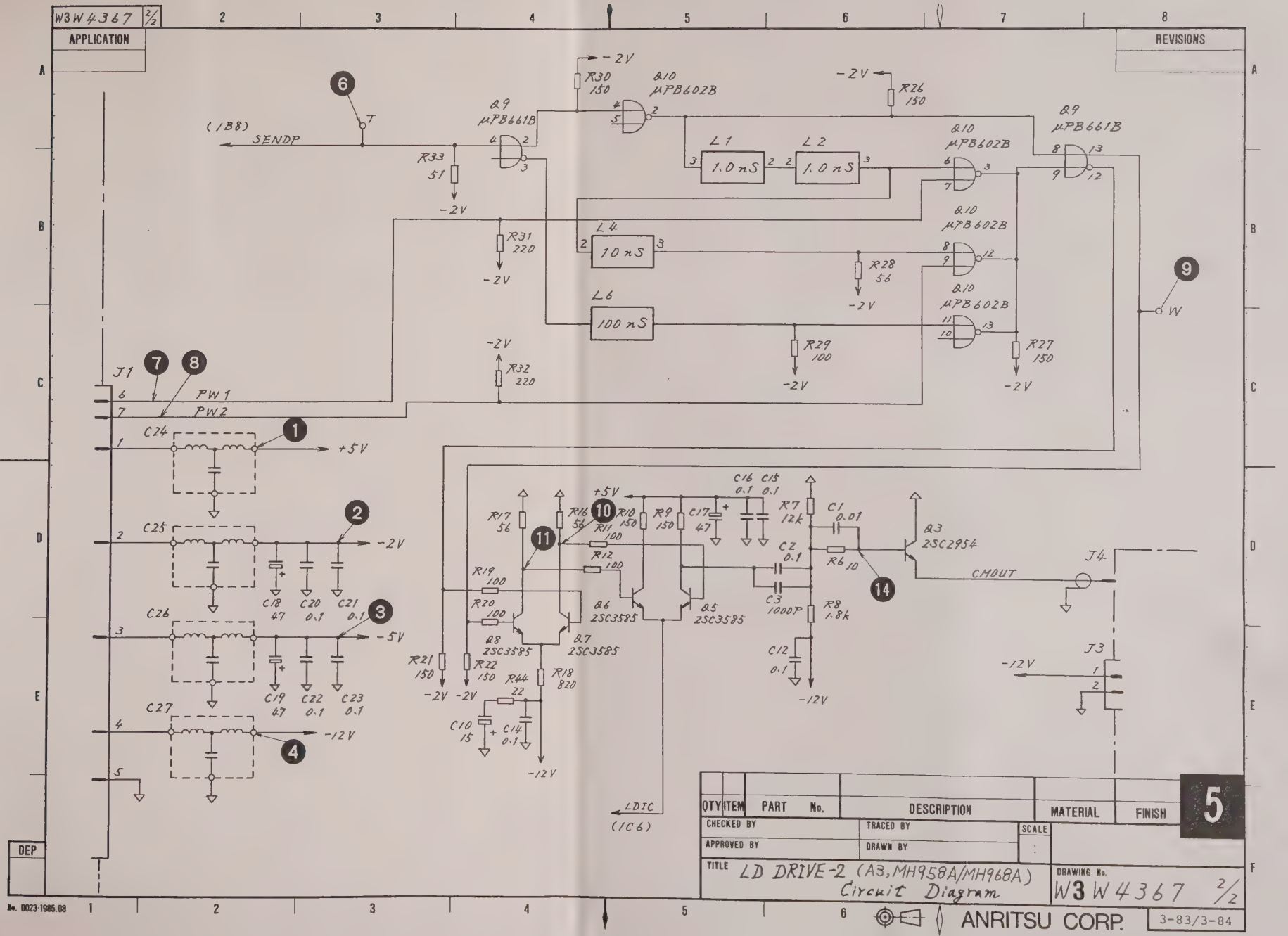

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

CHECKED BY | TRACED BY | SCALE

APPROVED BY | DRAWN BY

TITLE: LD DRIVE-2 (A3,MH958A/MH968A) Circuit Diagram

DRAWING No. W3W4367 2/2

DEP

No. 0023-1985.08

ANRITSU CORP.

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5

3.6.6 A5 CONT & APD 6

(1) Circuit description

This PC board consists of for sections; a part of the MW920A CPU I/O port, the power supply regulator, a section that detects whether the LD OUTPUT cover is open or not, and the APD bias control section.

Q1 and Q2 are the output ports for the plug-in unit and control the A1 AMP offset, select the pulse width, switch the LD drive current, and switch the A1 AMP filter.

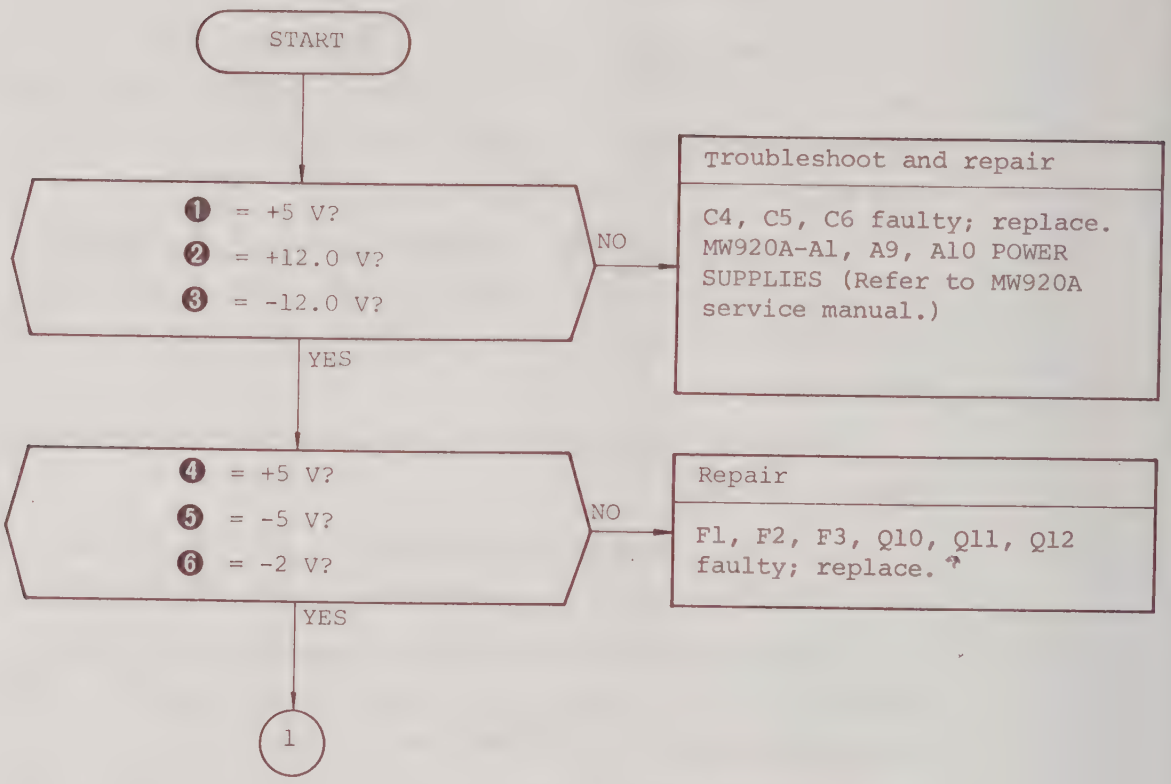
Q3 is the input port to detect the plug-in unit type.

Q10, Q11, and Q12 generate the ±5 and -2 Vdc power supplies that are supplied to A3 LD DRIVER-2.

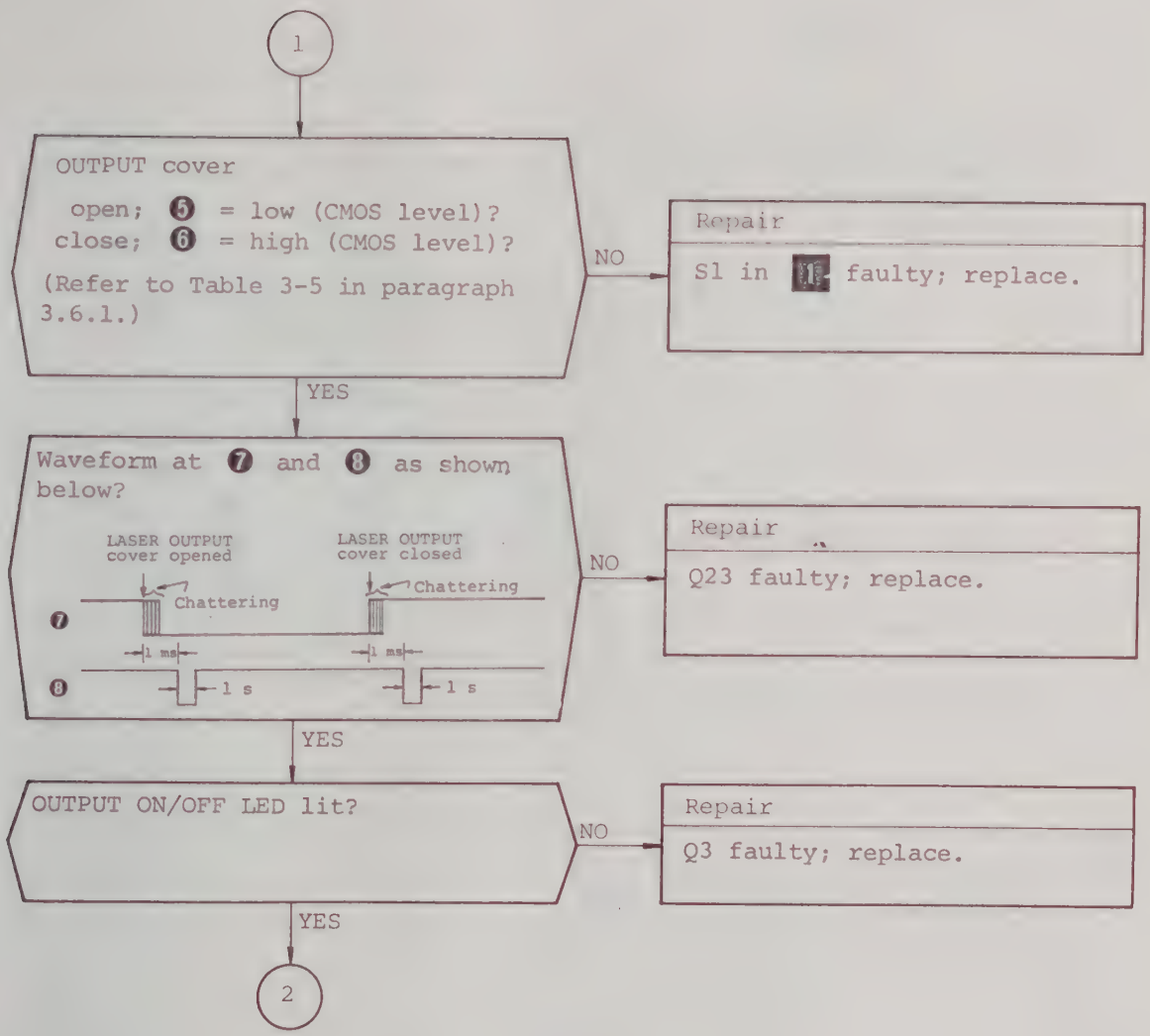
The microswitch S1 detects whether the LASER OUTPUT cover is opened or closed, and sends the Q23-processed signal to the MW920A.

The APD bias control section rectifies the high voltage from the MW920A and supplies the bias voltage to the APD via A2-A1 I/V CONV. Because the APD amplification gain varies with temperature, the APD bias voltage must be compensated according to the temperature to stabilize the amplification gain. For this purpose, a thermistor near the APD controls the APD bias. The APD bias voltage and amplification gain differ according to the plug-in unit type.

(2) Troubleshooting and repair



--- Control check for OUTPUT ON/OFF LED ---



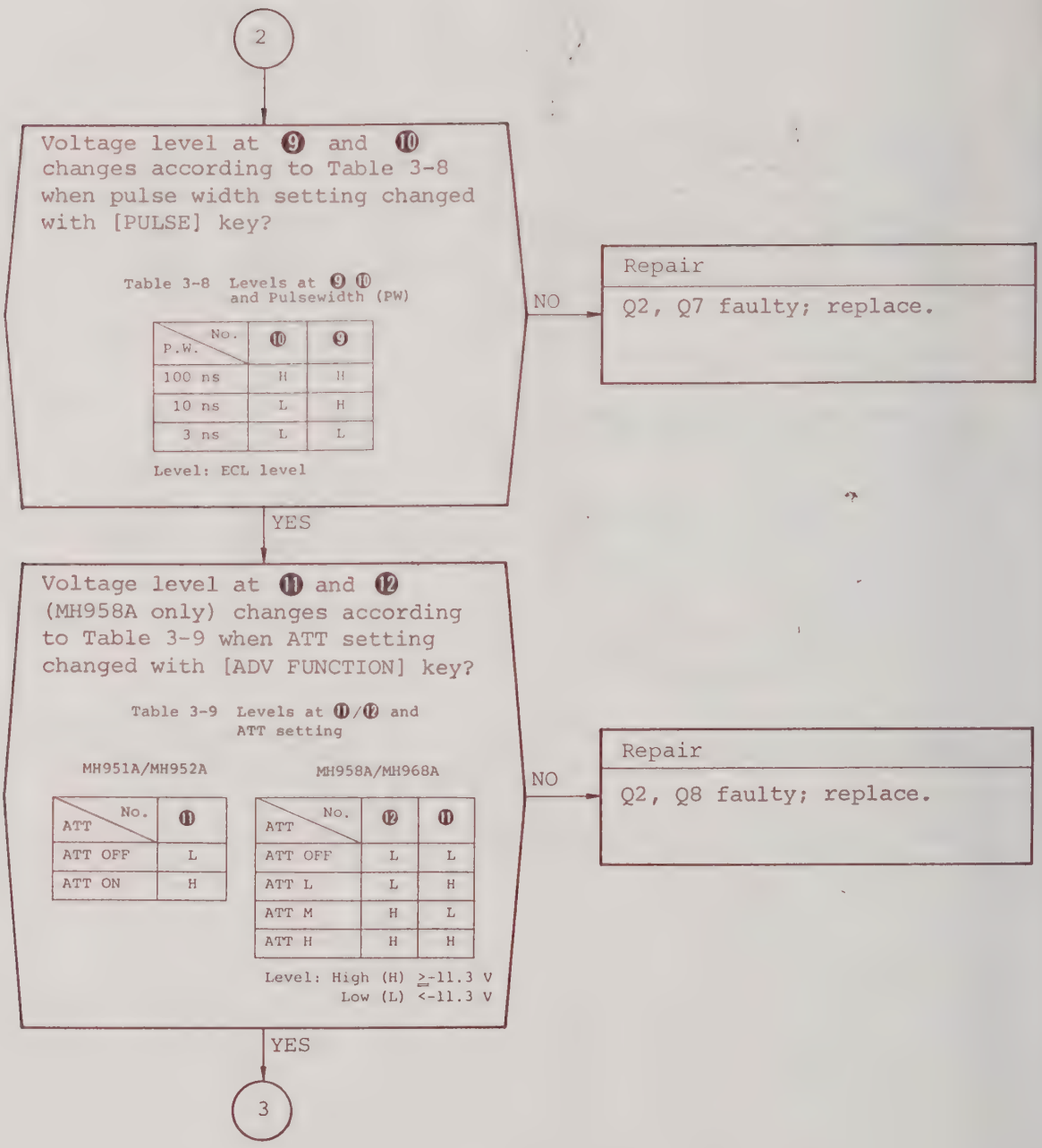

2
Voltage level at ⑨ and ⑩ changes according to Table 3-8 when pulse width setting changed with [PULSE] key?
NO
Repair
Q2, Q7 faulty; replace.
YES
Voltage level at ⑪ and ⑫ (MH958A only) changes according to Table 3-9 when ATT setting changed with [ADV FUNCTION] key?
NO
Repair
Q2, Q8 faulty; replace.
YES
3

Table 3-8 Levels at ⑨ ⑩ and Pulsewidth (PW)

P.W. \ No.	⑩	⑨
100 ns	H	H
10 ns	L	H
3 ns	L	L

Level: ECL level

Table 3-9 Levels at ⑪/⑫ and ATT setting

MH951A/MH952A

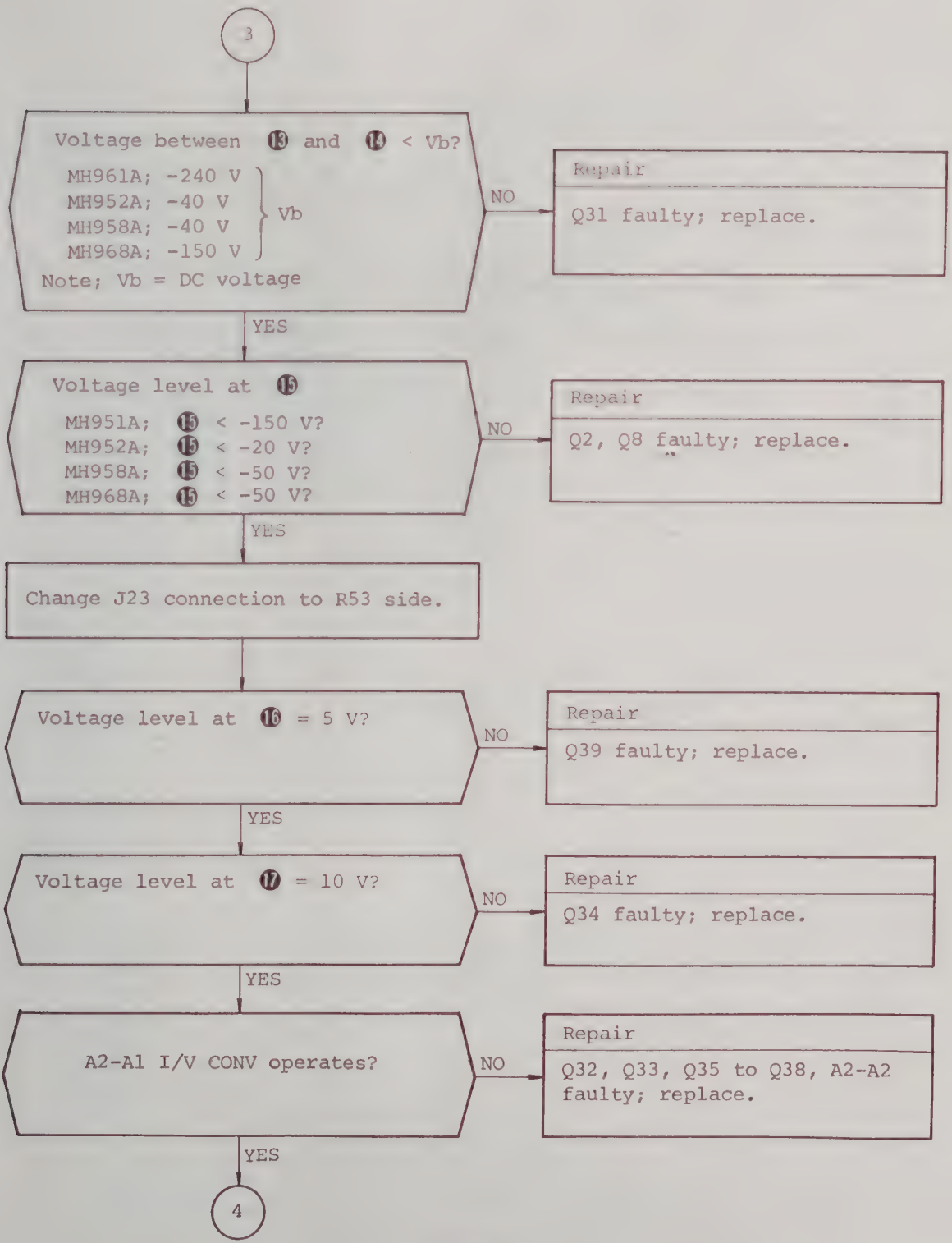
ATT \ No.	⑪
ATT OFF	L
ATT ON	H

MH958A/MH968A

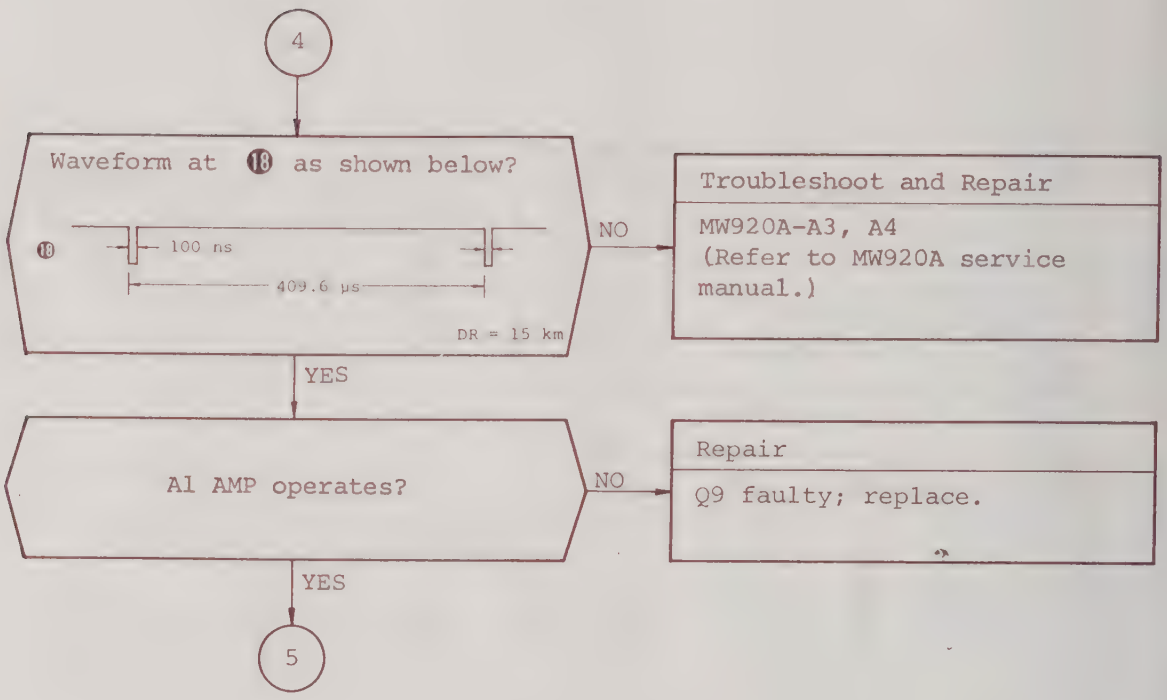
ATT \ No.	⑫	⑪
ATT OFF	L	L
ATT L	L	H
ATT M	H	L
ATT H	H	H

Level: High (H) ≧-11.3 V
Low (L) <-11.3 V

--- Control check for A2-A1 I/V CONV operation ---



--- Control check for A1 AM operation ---



--- Control check for A6 A/O TIMING (MH958A/MH968A) operation ---

5

Voltage level at ⑲ and ⑳ change according to Table 3-10 when pulse width setting changed with [PLUSE] key?

Table 3-10 Levels at ⑲/⑳ and Pulsewidth (PW)

P.W. \ No.	⑳	⑲
100 ns	L	L
10 ns	H	L
3 ns	H	H

Level: CMOS level

NO → Repair: Q2 faulty; replace.

YES

---------- Control check for wavelength value/ plug-in unit name display ----------

Check J8 to J10, J12 and J13 according to the following table?

Table 3-11

Plug-in unit	J8	J9	J10	J12	J13
MH951A	1	X	X	0	1
MH952A	X	1	0	0	1
MH958A	1	1	0	0	1
MH968A	0	0	1	0	1

1: Short X: Connector not provided
0: Open

NO → Repair: Q3 faulty; replace.

YES

END

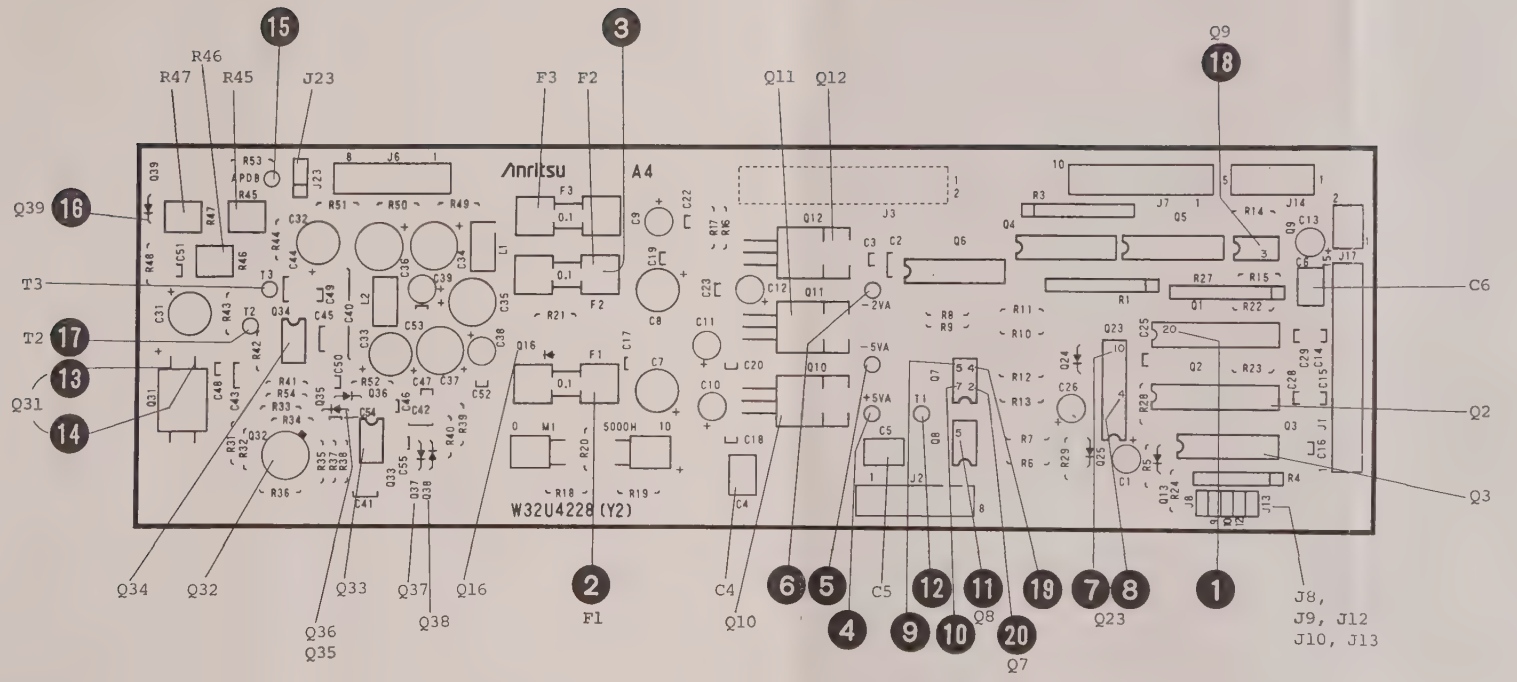
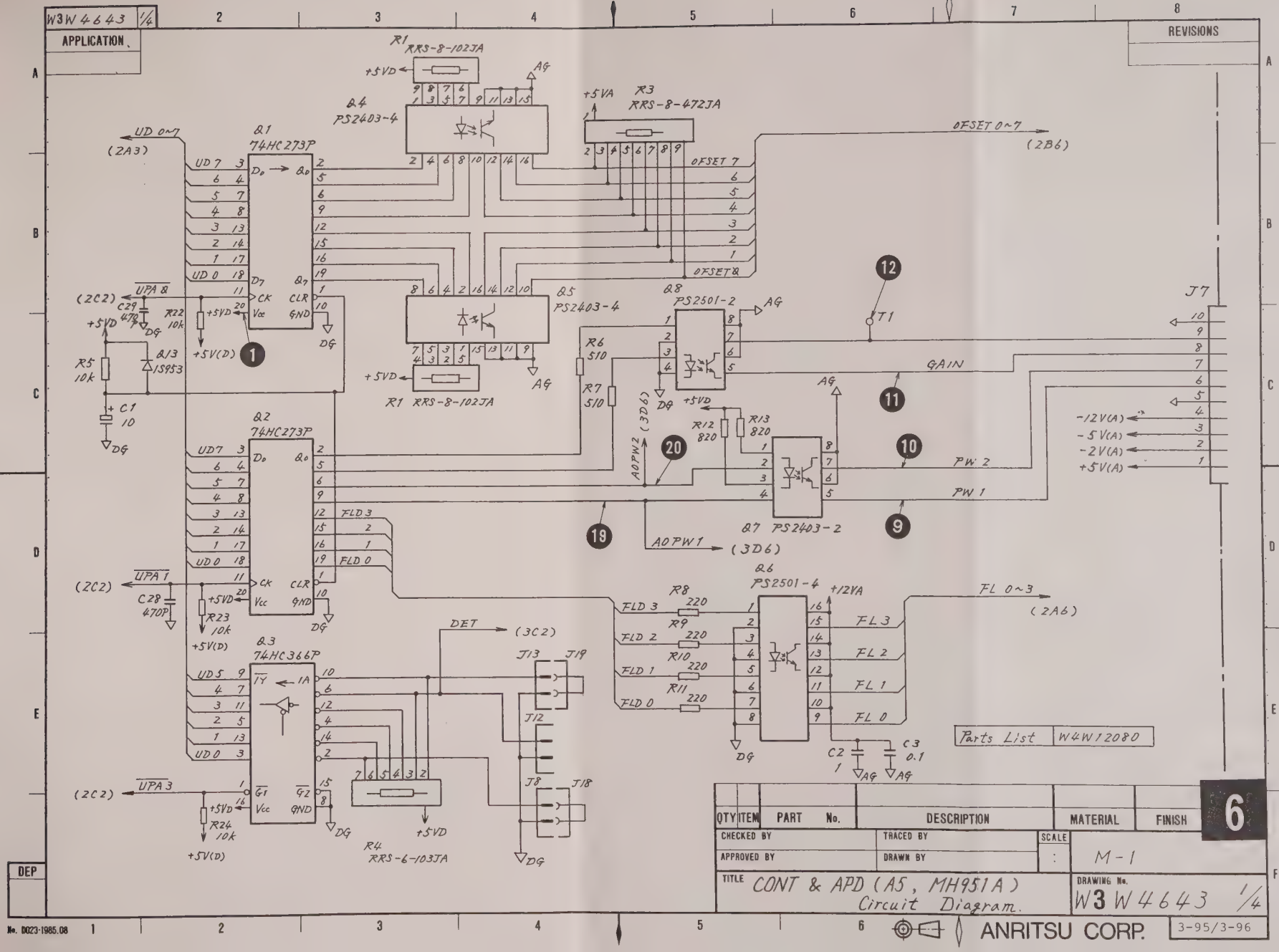
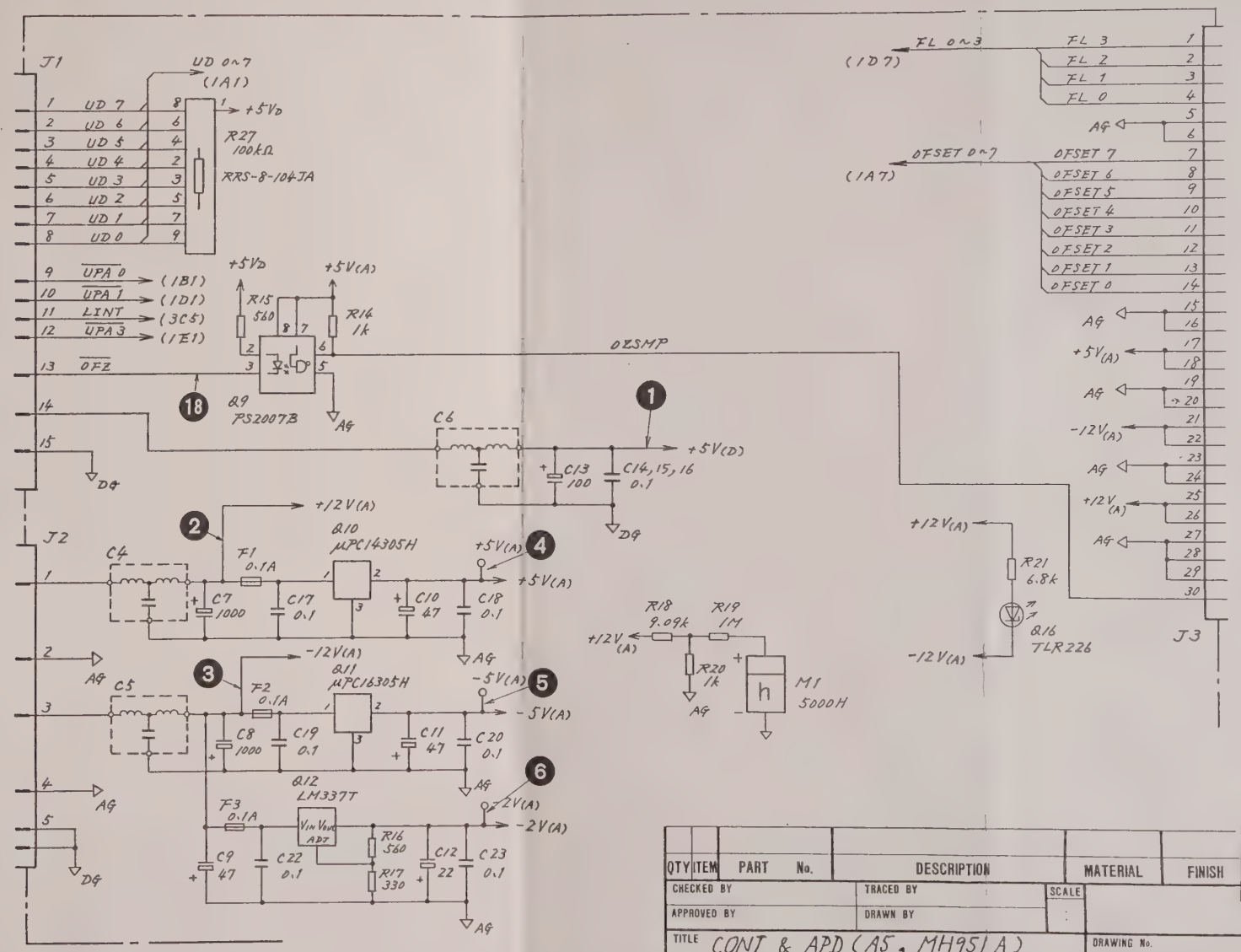


Fig. 3-16 A5 CONT & APD PC Board
Parts Layout 6


W3W4643 1/4
APPLICATION
REVISIONS
Q1 74HC273P
Q2 74HC273P
Q3 74HC366P
Q4 PS2403-4
Q5 PS2403-4
Q6 PS2501-4
Q7 PS2403-2
Q8 PS2501-2
R1 RRS-8-102JA
R3 RRS-8-472JA
R4 RRS-6-103JA
R5 10k
R6 510
R7 510
R8 220
R9 220
R10 220
R11 220
R12 820
R13 820
R22 10k
R23 10k
R24 10k
C1 10
C2 1
C3 0.1
C28 470P
C29 470P
D13 1S953
UD 0~7
(2A3)
OFSET 0~7
(2B6)
OFSET 7
OFSET 0
GAIN
PW 2
PW 1
AOPW2 (3D6)
AOPW1 (3D6)
DET
(3C2)
FL 0~3
(2A6)
-12V(A)
-5V(A)
-2V(A)
+5V(A)
+5V(D)
+5VD
+5VA
+12VA
AG
DG
UPA 0
UPA 1
UPA 3
(2C2)
J7
J8
J12
J13
J18
J19
T1
Parts List W4W12080
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY
APPROVED BY
TRACED BY
DRAWN BY
SCALE : M-1
TITLE CONT & APD (A5, MH951A) Circuit Diagram.
DRAWING No. W3W4643 1/4
DEP
ANRITSU CORP.
3-95/3-96
No. 0023-1985.08

APPLICATION

REVISIONS



QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

CHECKED BY | TRACED BY | SCALE

APPROVED BY | DRAWN BY

TITLE CONT & APD (A5, MH951A)
Circuit Diagram

DRAWING No. W3 W 4643 2/4

6

DEP

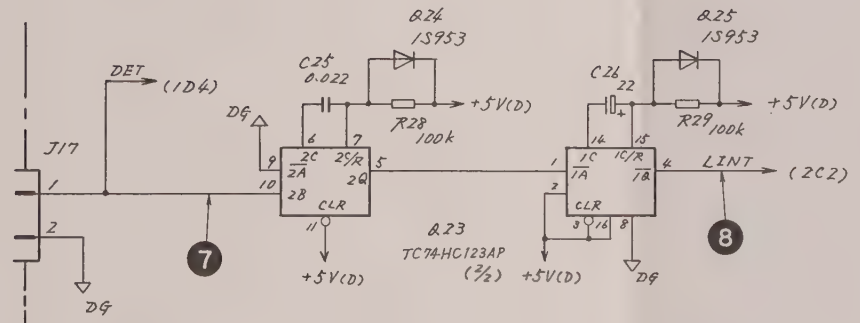
ANRITSU CORP.

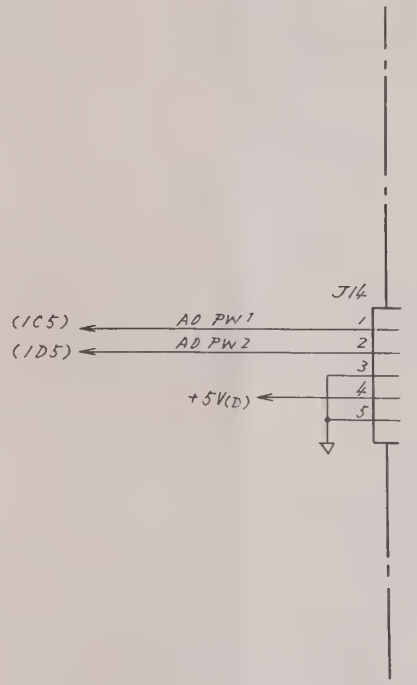
3-97/3-98

W3W4643 3/4

APPLICATION

REVISIONS





QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

6

CHECKED BY | TRACED BY | SCALE

APPROVED BY | DRAWN BY | : M-1

TITLE CONT & APD (A5, MH951A) Circuit Diagram

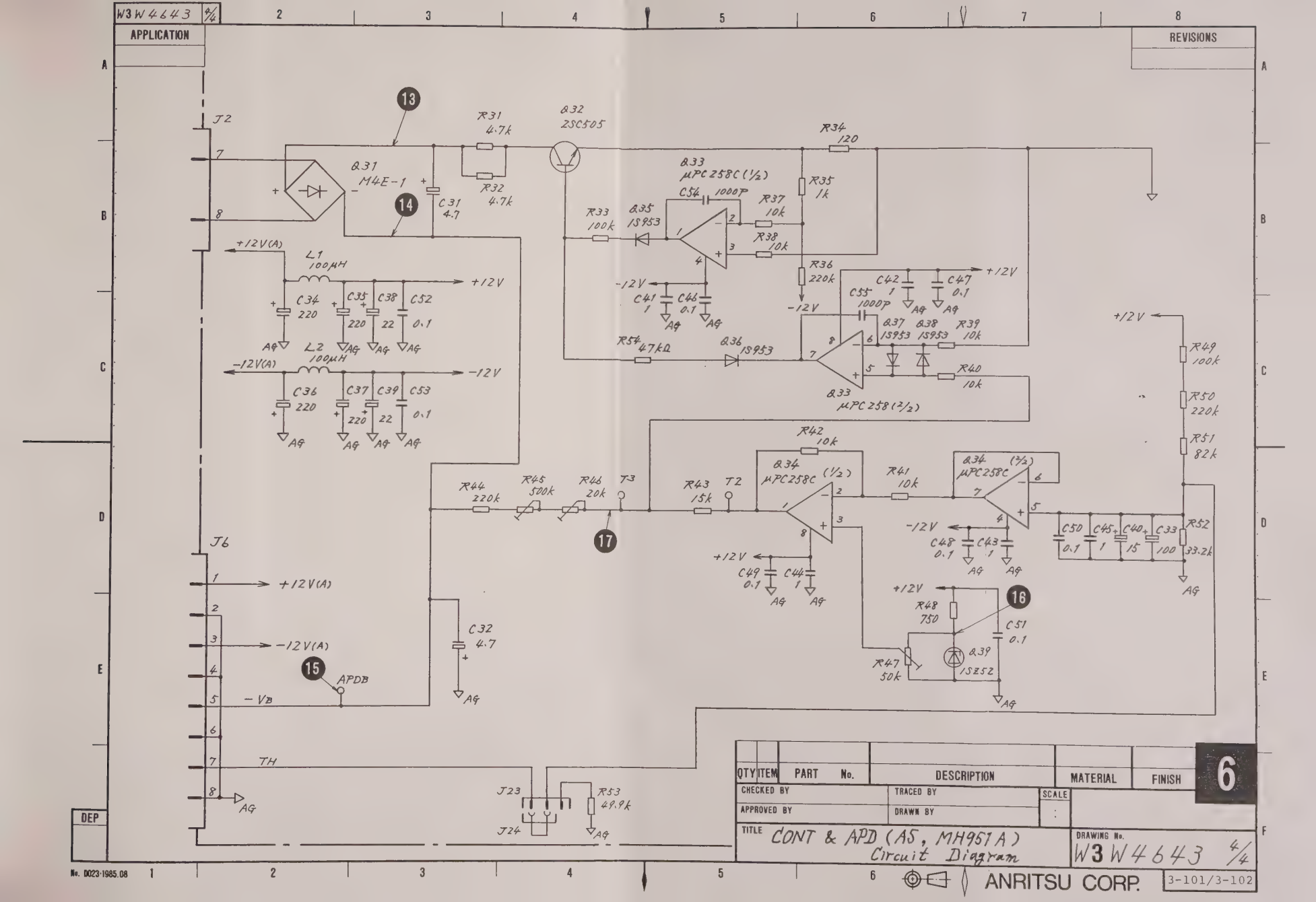
DRAWING No. W3W4643 3/4

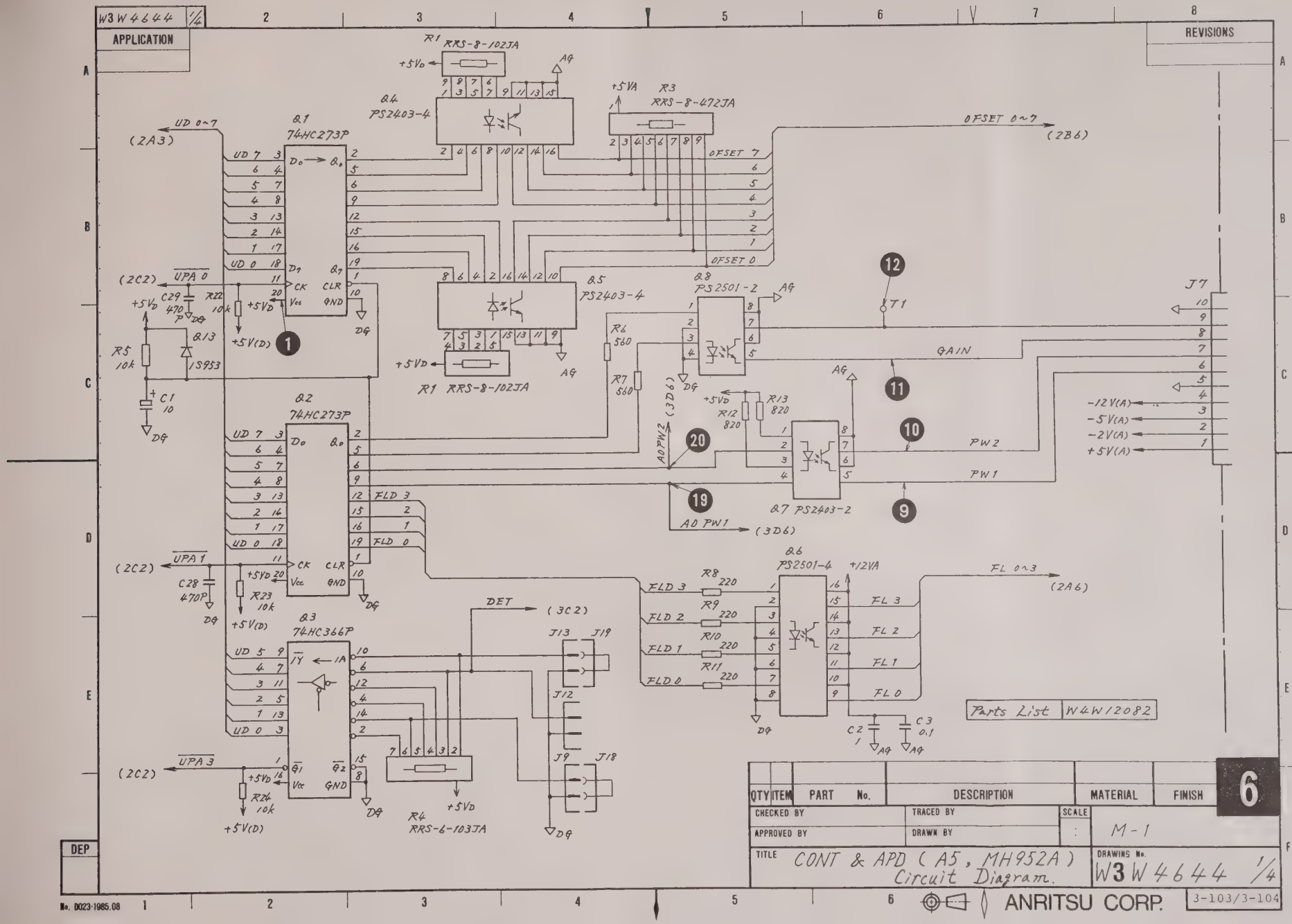
DEP

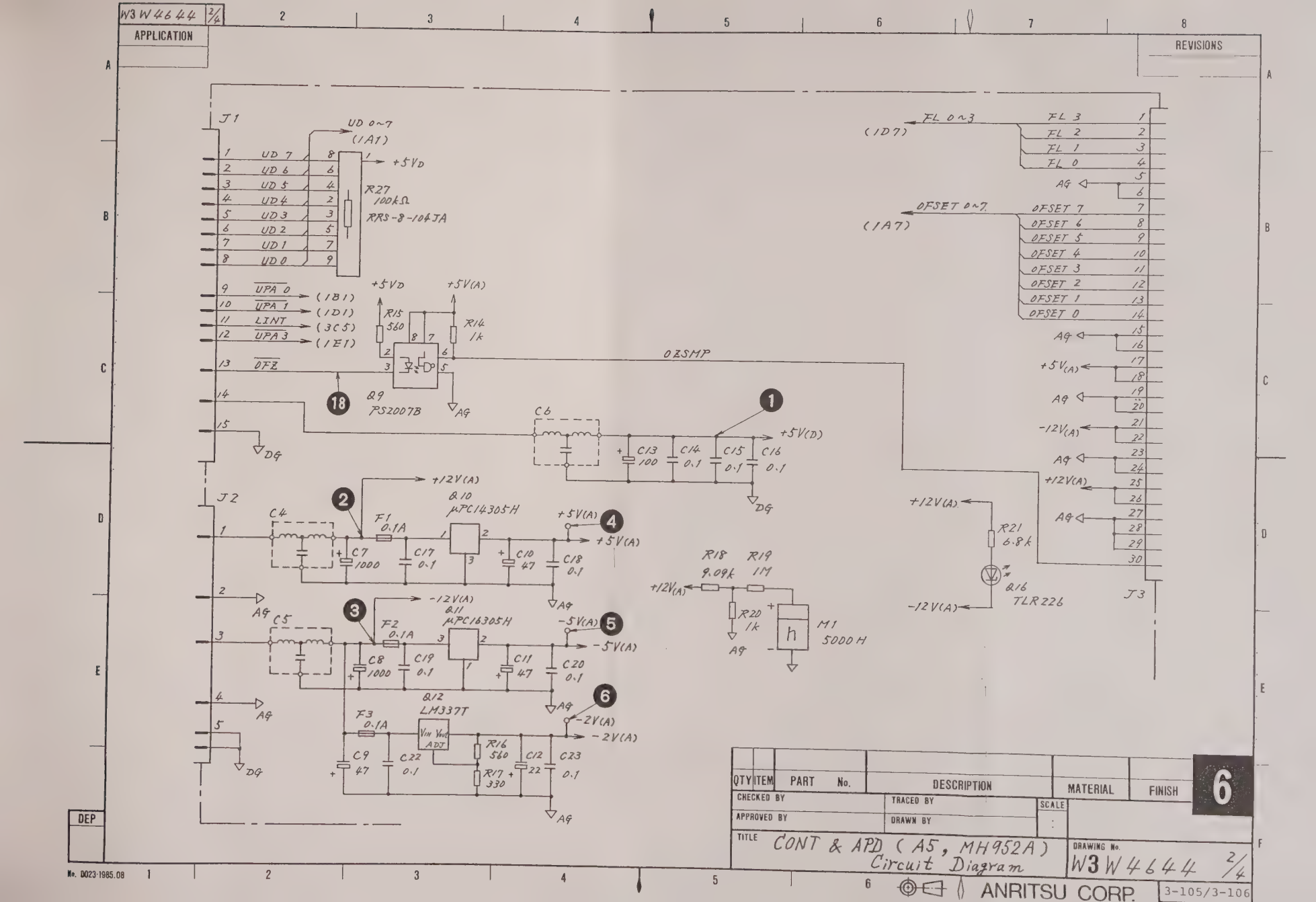
No. D023-1985.08

ANRITSU CORP.

3-99/3-100

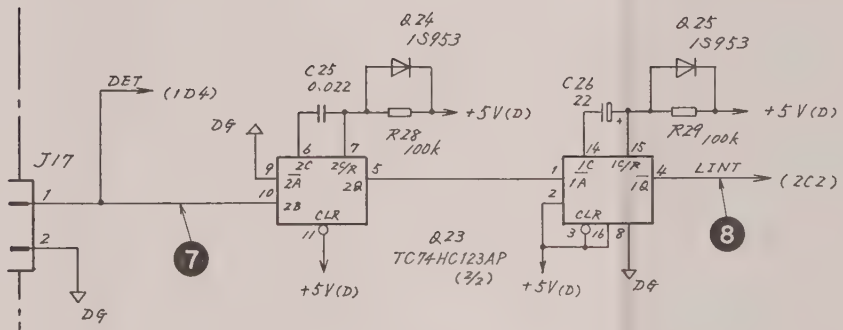

W3W4643 4/4
APPLICATION
REVISIONS
J2
Q31 M4E-1
C31 4.7
R31 4.7k
R32 4.7k
Q32 2SC505
R34 120
Q33 μPC258C (1/2)
C54 1000P
R35 1k
R37 10k
R38 10k
R33 100k
Q35 1S953
R36 220k
C55 1000P
Q37 1S953
Q38 1S953
R39 10k
R40 10k
R54 47kΩ
Q36 1S953
Q33 μPC258 (2/2)
+12V(A)
L1 100μH
+12V
C34 220
C35 220
C38 22
C52 0.1
AG
L2 100μH
-12V(A)
-12V
C36 220
C37 220
C39 22
C53 0.1
C41 1
C46 0.1
C42 1
C47 0.1
R42 10k
Q34 μPC258C (1/2)
R41 10k
Q34 (2/2)
R44 220k
R45 500k
R46 20k
T3
R43 15k
T2
C48 0.1
C43 1
C49 0.1
C44 1
C50 0.1
C45 1
C40 15
C33 100
R52 33.2k
R49 100k
R50 220k
R51 82k
J6
+12V(A)
-12V(A)
-VB
APDB
C32 4.7
R48 750
C51 0.1
Q39 1SZ52
R47 50k
TH
J23
J24
R53 49.9k
DEP
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY TRACED BY SCALE
APPROVED BY DRAWN BY
TITLE CONT & APD (AS, MH951A) Circuit Diagram
DRAWING No. W3W4643 4/4
ANRITSU CORP.
3-101/3-102
No. 0023-1985.08

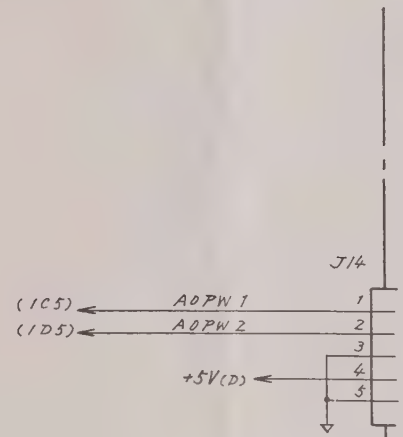

W3W4644 1/4
APPLICATION
REVISIONS
R1 RRS-8-102JA
Q4 PS2403-4
R3 RRS-8-472JA
Q1 74HC273P
Q2 74HC273P
Q3 74HC366P
Q5 PS2403-4
Q8 PS2501-2
Q7 PS2403-2
Q6 PS2501-4
R4 RRS-6-103JA
OFFSET 0~7
(2B6)
UD 0~7
(2A3)
GAIN
PW2
PW1
(3D6)
FLD 3
FLD 2
FLD 1
FLD 0
FL 0~3
(2A6)
DET
(3C2)
-12V(A)
-5V(A)
-2V(A)
+5V(A)
Parts List W4W12082
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY TRACED BY SCALE M-1
APPROVED BY DRAWN BY
TITLE CONT & APD (A5, MH952A) Circuit Diagram.
DRAWINGS No. W3W4644 1/4
DEP
ANRITSU CORP.
3-103/3-104
No. 0023-1985.08


W3W4644 2/4
APPLICATION
REVISIONS
J1
UD 0~7
(1A1)
UD 7
UD 6
UD 5
UD 4
UD 3
UD 2
UD 1
UD 0
+5VD
R27
100kΩ
RRS-8-104JA
UPA 0
UPA 1
LINT
UPA 3
(1B1)
(1D1)
(3C5)
(1E1)
OFF
+5VD
+5V(A)
R15
560
R14
1k
Q9
PS2007B
AG
DG
OZSMP
C6
C13
100
C14
0.1
C15
0.1
C16
0.1
+5V(D)
J2
+12V(A)
Q10
μPC14305H
F1
0.1A
C4
C7
1000
C17
0.1
C10
47
C18
0.1
+5V(A)
C5
-12V(A)
Q11
μPC16305H
F2
0.1A
C8
1000
C19
0.1
C11
47
C20
0.1
-5V(A)
Q12
LM337T
F3
0.1A
C9
47
C22
0.1
R16
560
R17
330
C12
22
C23
0.1
-2V(A)
R18
9.09k
R19
1M
R20
1k
M1
5000H
FL 0~3
(1D7)
FL 3
FL 2
FL 1
FL 0
OFSET 0~7
(1A7)
OFSET 7
OFSET 6
OFSET 5
OFSET 4
OFSET 3
OFSET 2
OFSET 1
OFSET 0
R21
6.8k
Q16
TLR226
J3
DEP
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY
TRACED BY
APPROVED BY
DRAWN BY
SCALE
TITLE CONT & APD (A5, MH952A) Circuit Diagram
DRAWING No. W3W4644 2/4
ANRITSU CORP.
3-105/3-106
No. 0023-1985.08

APPLICATION

REVISIONS





QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

CHECKED BY | TRACED BY | SCALE : M-1

APPROVED BY | DRAWN BY

TITLE: CONT & APD (A5 , MH952A)
Circuit Diagram

DRAWING No. W3 W4644 3/4

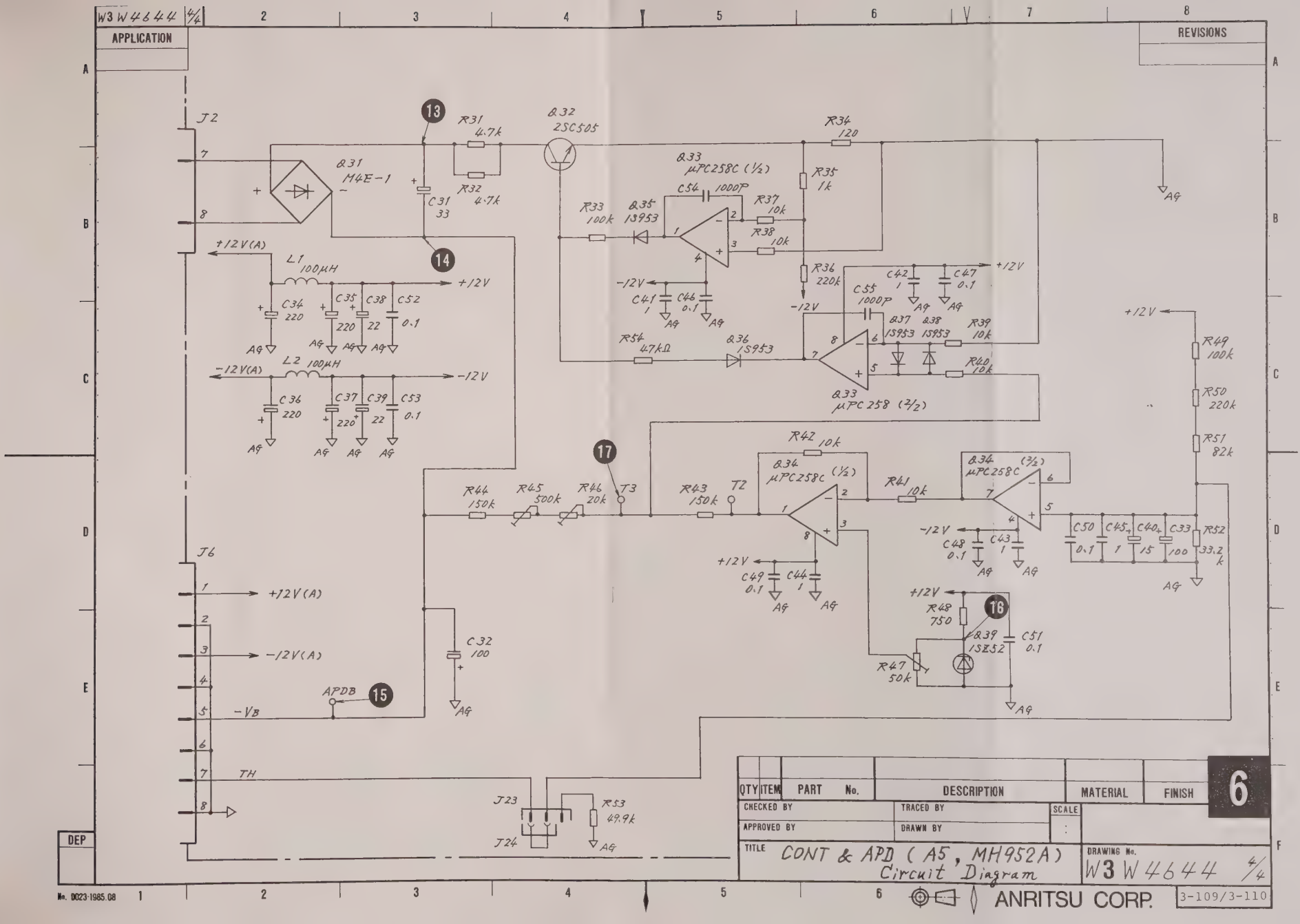
6

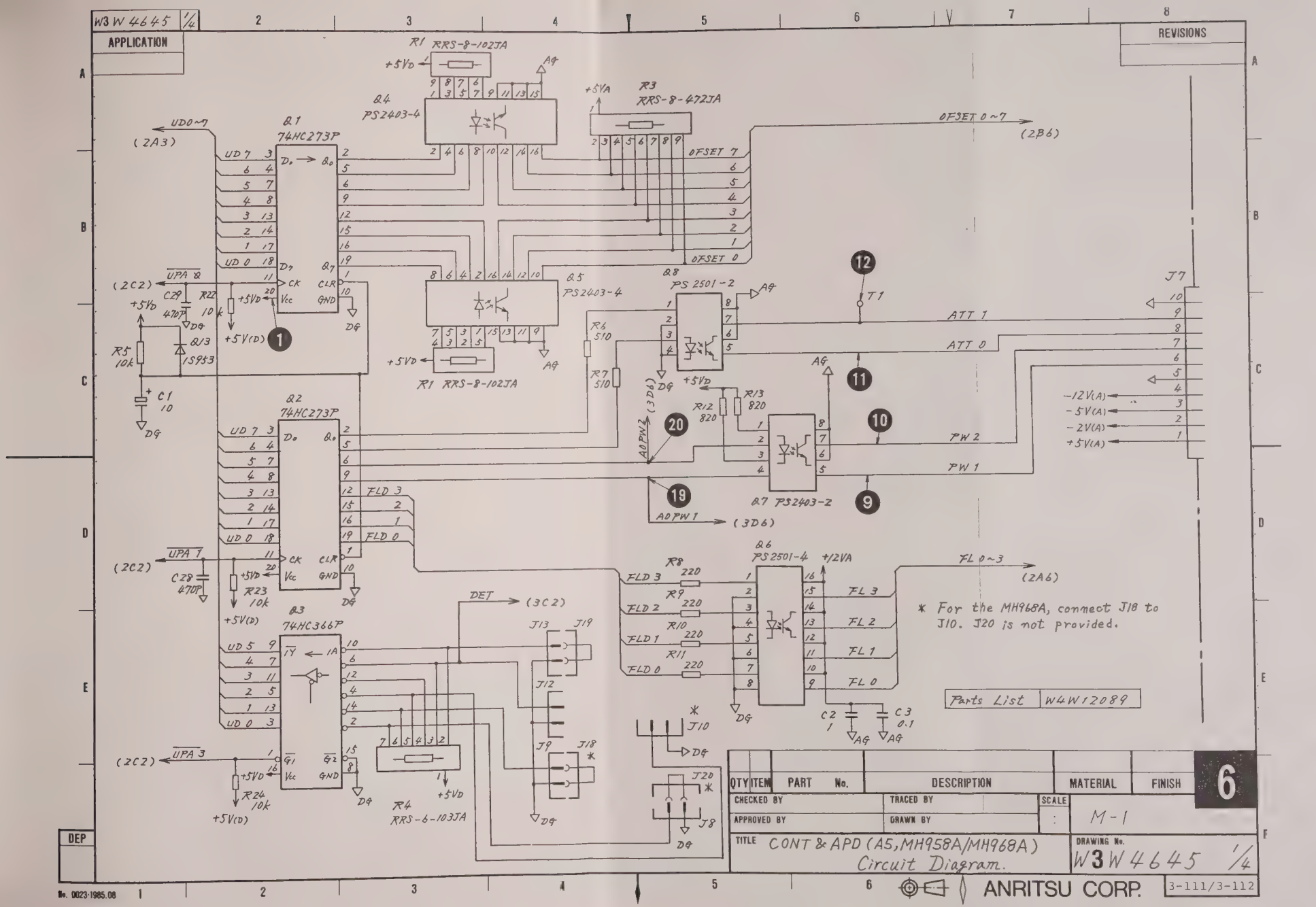
DEP

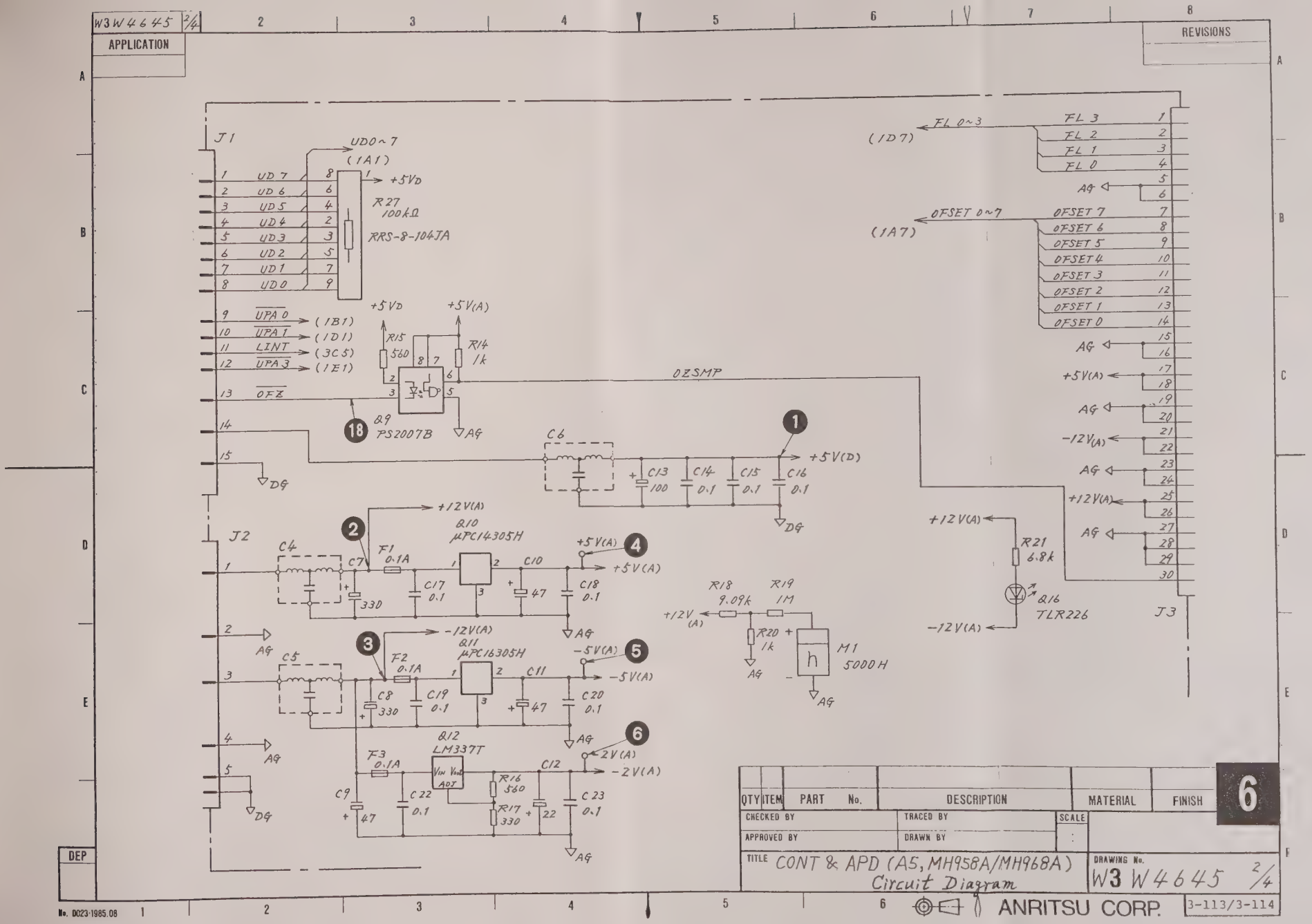
No. 0023-1985.08

ANRITSU CORP.

3-107/3-108

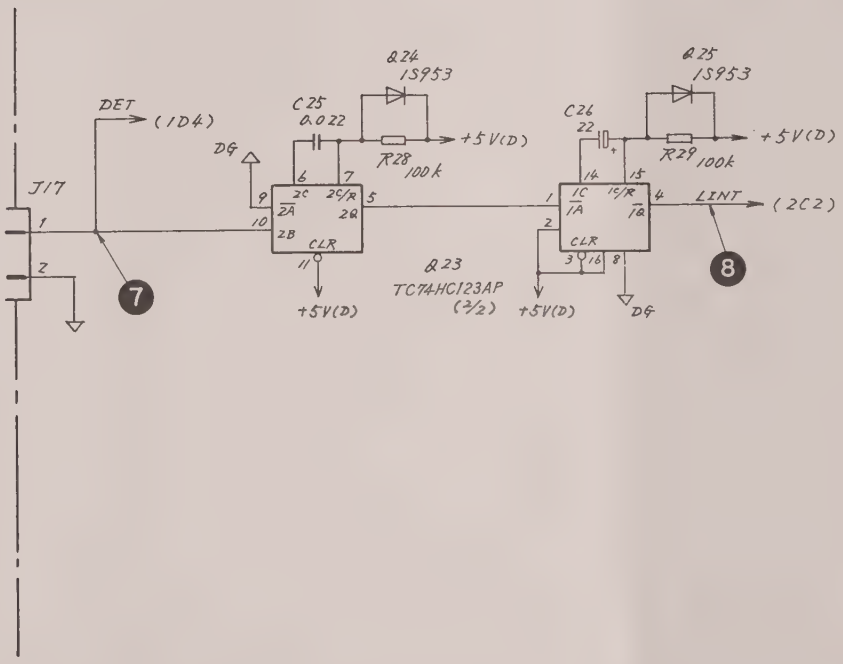

W3 W4644 4/4
APPLICATION
REVISIONS
J2
Q31 M4E-1
C31 33
R31 4.7k
R32 4.7k
Q32 2SC505
R34 120
Q33 μPC258C (1/2)
C54 1000P
R33 100k
Q35 1S953
R37 10k
R38 10k
R35 1k
R36 220k
C55 1000P
Q37 1S953
Q38 1S953
R39 10k
R40 10k
Q33 μPC258 (2/2)
C42 1
C47 0.1
C41 1
C46 0.1
R54 47kΩ
Q36 1S953
+12V(A)
L1 100μH
+12V
C34 220
C35 220
C38 22
C52 0.1
-12V(A)
L2 100μH
-12V
C36 220
C37 220
C39 22
C53 0.1
AG
R49 100k
R50 220k
R51 82k
R52 33.2k
C50 0.1
C45 1
C40 15
C33 100
R42 10k
Q34 μPC258C (1/2)
Q34 (2/2) μPC258C
R41 10k
R44 150k
R45 500k
R46 20k
R43 150k
T2
T3
C43 1
C48 0.1
C49 0.1
C44 1
J6
+12V(A)
-12V(A)
-VB
TH
APDB
C32 100
R48 750
Q39 1SZ52
C51 0.1
R47 50k
J23
J24
R53 49.9k
13
14
15
16
17
DEP
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY
TRACED BY
APPROVED BY
DRAWN BY
SCALE
TITLE CONT & APD (A5, MH952A) Circuit Diagram
DRAWING No. W3 W4644 4/4
6
ANRITSU CORP.
3-109/3-110
No. 0023-1985.08

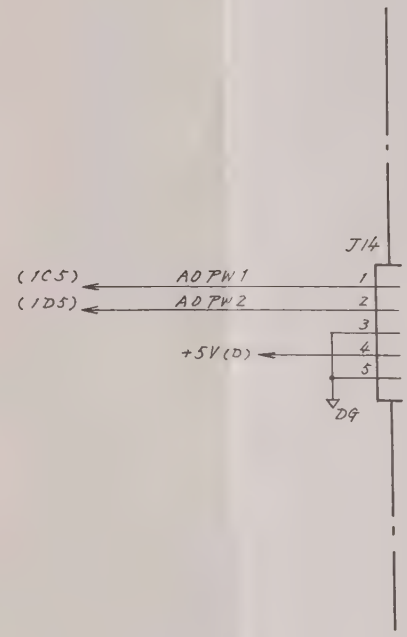

W3 W 4645 1/4
APPLICATION
REVISIONS
R1 RRS-8-102JA
+5VD
AG
Q4 PS2403-4
+5VA
R3 RRS-8-472JA
UD0~7
(2A3)
Q1 74HC273P
UD 7
UD 0
D0
Q0
D7
Q7
CK
CLR
Vcc
GND
OFSET 0~7
(2B6)
OFSET 7
OFSET 0
UPA 0
(2C2)
C29 470P
R22 10k
DG
+5V(D)
1
R5 10k
Q13 1S953
C1 10
Q5 PS2403-4
R1 RRS-8-102JA
Q8 PS 2501-2
R6 510
R7 510
(3D6)
12
T1
ATT 1
ATT 0
J7
10
9
8
7
6
5
4
3
2
1
11
R13 820
R12 820
20
ADPW2
10
PW 2
PW 1
19
ADPW1
Q7 PS2403-2
9
-12V(A)
-5V(A)
-2V(A)
+5V(A)
Q2 74HC273P
FLD 3
FLD 0
UPA 1
C28 470P
R23 10k
Q3 74HC366P
UD 5
UD 0
1Y
1A
G1
G2
UPA 3
R24 10k
DET
(3C2)
J13
J19
J12
J9
J18
R4 RRS-6-103JA
Q6 PS2501-4
+12VA
R8 220
R9 220
R10 220
R11 220
FLD 3
FLD 2
FLD 1
FLD 0
FL 3
FL 2
FL 1
FL 0
FL 0~3
(2A6)
* For the MH968A, connect J18 to J10. J20 is not provided.
Parts List W4W12089
C2 1
C3 0.1
J10
J20
J8
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
6
CHECKED BY
TRACED BY
SCALE
APPROVED BY
DRAWN BY
M-1
TITLE CONT & APD (A5, MH958A/MH968A) Circuit Diagram.
DRAWING No. W3W4645 1/4
DEP
No. 0023-1985.08
ANRITSU CORP.
3-111/3-112


W3W4645 2/4
APPLICATION
REVISIONS
J1
UD0~7
(1A1)
UD 7
UD 6
UD 5
UD 4
UD 3
UD 2
UD 1
UD 0
+5VD
R27
100kΩ
RRS-8-104JA
UPA 0
UPA 1
LINT
UPA 3
OFZ
(1B1)
(1D1)
(3C5)
(1E1)
+5VD
+5V(A)
R15
560
R14
1k
Q9
PS2007B
18
AG
DG
OZSMP
C6
C13
100
C14
0.1
C15
0.1
C16
0.1
+5V(D)
1
J2
+12V(A)
2
Q10
μPC14305H
C4
C7
F1
0.1A
C10
+5V(A)
4
C17
0.1
47
C18
0.1
330
3
-12V(A)
Q11
μPC16305H
C5
F2
0.1A
C11
-5V(A)
5
C8
330
C19
0.1
C20
0.1
Q12
LM337T
F3
0.1A
C12
-2V(A)
6
R16
560
R17
330
C9
47
C22
0.1
22
C23
0.1
R18
9.09k
R19
1M
R20
1k
M1
5000H
R21
6.8k
Q16
TLR226
J3
FL 0~3
(1D7)
FL 3
FL 2
FL 1
FL 0
OFSET 0~7
(1A7)
OFSET 7
OFSET 6
OFSET 5
OFSET 4
OFSET 3
OFSET 2
OFSET 1
OFSET 0
DEP
QTY ITEM PART No.
DESCRIPTION
MATERIAL
FINISH
CHECKED BY
TRACED BY
APPROVED BY
DRAWN BY
SCALE
TITLE CONT & APD (A5, MH958A/MH968A)
Circuit Diagram
DRAWING No. W3W4645 2/4
ANRITSU CORP.
3-113/3-114
No. 0023-1985.08

APPLICATION

REVISIONS





QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

6

CHECKED BY | TRACED BY | SCALE : M-1

APPROVED BY | DRAWN BY

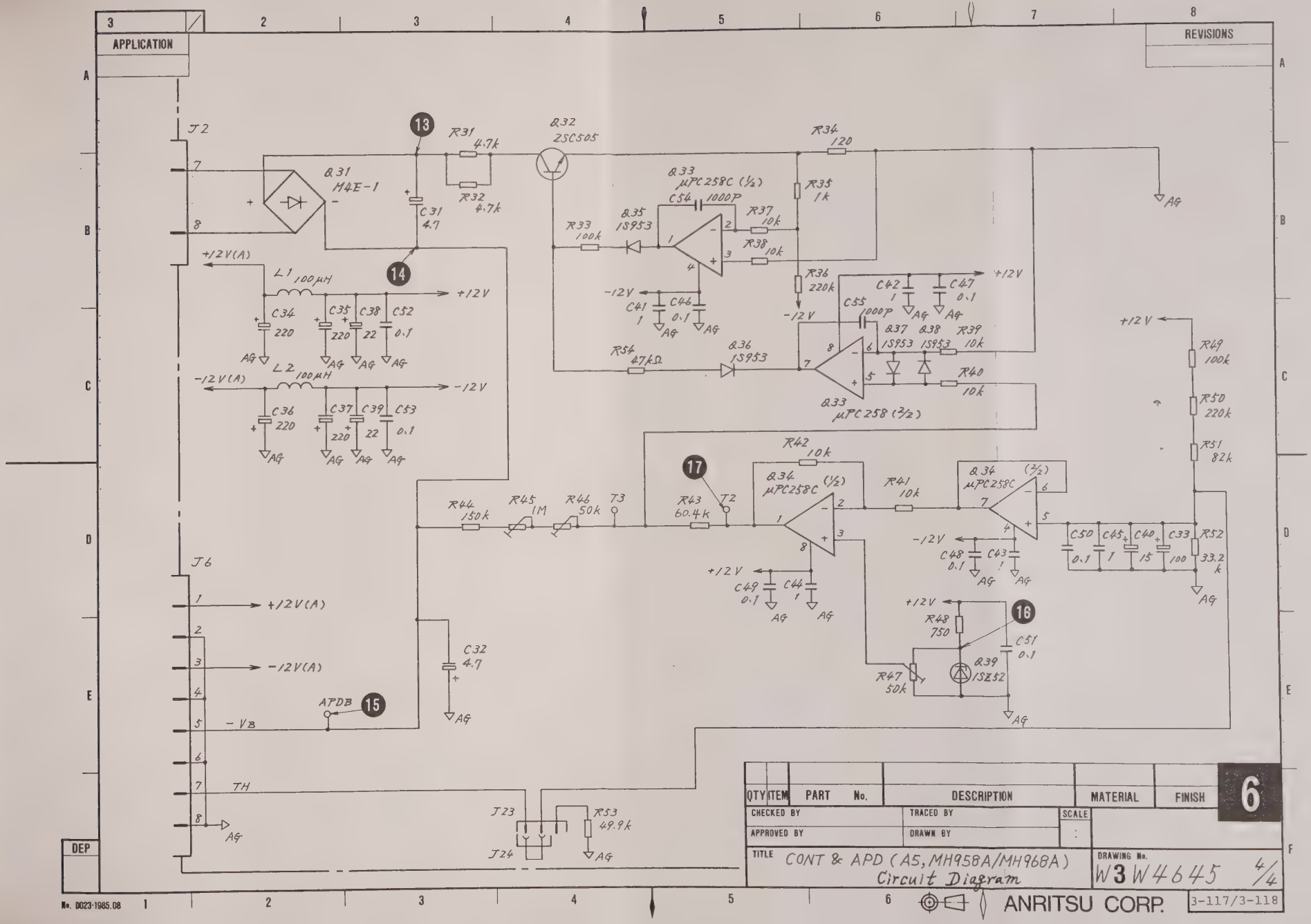
TITLE CONT & APD (A5, MH958A/MH968A) Circuit Diagram

DRAWING No. W3W4645 3/4

DEP

No. 0023-1985.08

ANRITSU CORP.


APPLICATION
REVISIONS
J2
J6
Q31 M4E-1
C31 4.7
R31 4.7k
R32 4.7k
Q32 2SC505
R34 120
Q33 μPC258C (½)
C54 1000P
R35 1k
R37 10k
R38 10k
Q35 1S953
R33 100k
R36 220k
C42 1
C47 0.1
C55 1000P
Q37 1S953
Q38 1S953
R39 10k
R40 10k
Q33 μPC258 (2/2)
R54 47kΩ
Q36 1S953
C41 1
C46 0.1
+12V(A)
-12V(A)
L1 100μH
L2 100μH
C34 220
C35 220
C38 22
C52 0.1
C36 220
C37 220
C39 22
C53 0.1
+12V
-12V
AG
R42 10k
R44 150k
R45 1M
R46 50k
R43 60.4k
T3
T2
Q34 μPC258C (½)
R41 10k
Q34 μPC258C (2/2)
C48 0.1
C43 1
C49 0.1
C44 1
R49 100k
R50 220k
R51 82k
C50 0.1
C45 1
C40 15
C33 100
R52 33.2k
R48 750
C51 0.1
Q39 1SZ52
R47 50k
C32 4.7
APDB
-VB
TH
J23
J24
R53 49.9k
13
14
15
16
17
DEP
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY
TRACED BY
APPROVED BY
DRAWN BY
SCALE
TITLE CONT & APD (A5, MH958A/MH968A) Circuit Diagram
DRAWING No. W3W4645 4/4
6
ANRITSU CORP.
3-117/3-118
No. 0023-1985.08

3.6.7 A8 LD UNIT 7

(1) Circuit description

This unit consists of A8-A1 LD DRIVER-1, the LD, and the directional coupler. The unit receives the LD drive signal from A8 LD DRIVER-2 and emits the optical pulse by driving the LD.

The back-scattered light and Fresnel reflection light are branched by the directional coupler and sent to A2 RECEIVER.

(2) Troubleshooting and repair

Refer to paragraph 3.6.8 for A8-A1 LD DRIVER-1. When A8-A2 LD module is faulty, replace it.

APPLICATION	REVISIONS

Note: J3 is used for MH958A, MH968A.

Parts List	W4W14162

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

7

CHECKED BY	TRACED BY	SCALE
APPROVED BY	DRAWN BY	:

DEP

TITLE LD UNIT (A8, MH951A/MH952A/MH958A/MH968A)
Circuit Diagram

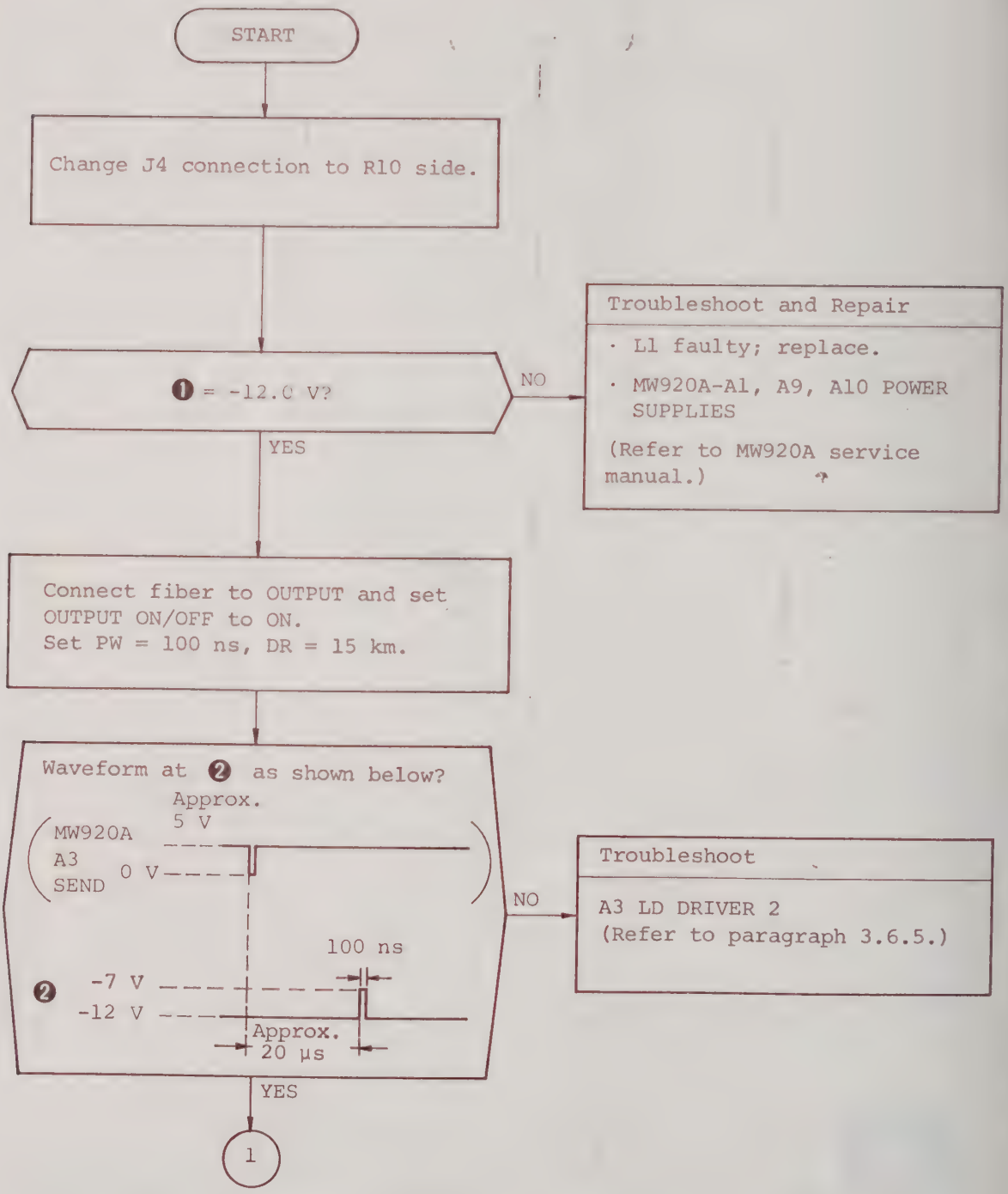
DRAWING No. W4W 14161 1/1

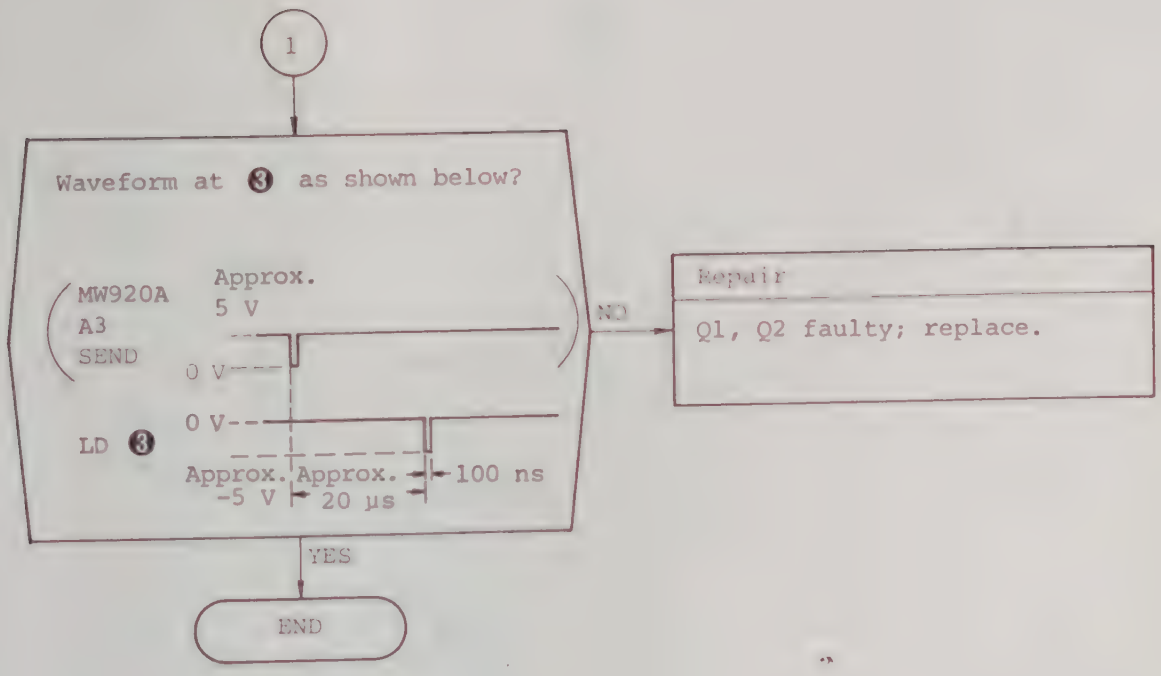
3.6.8 A8-A1 LD DRIVER-1

(1) Circuit description

This PC board uses the drive signal from A3 LD DRIVER-2 to drive the LD.

(2) Troubleshooting and repair




1
Waveform at ❸ as shown below?
MW920A
A3
SEND
Approx.
5 V
0 V
0 V
LD ❸
Approx.
-5 V
Approx.
20 µs
100 ns
NO
Repair
Q1, Q2 faulty; replace.
YES
END

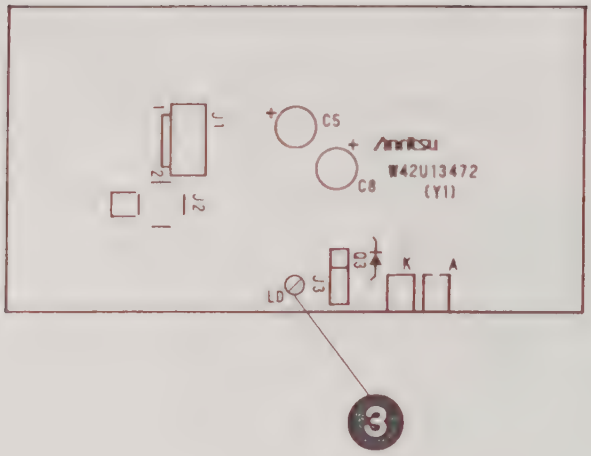


Fig. 3-17 A8-A1 LD DRIVER-1 PC Board Parts Layout-Front Side (MH951A, MH952A) 8

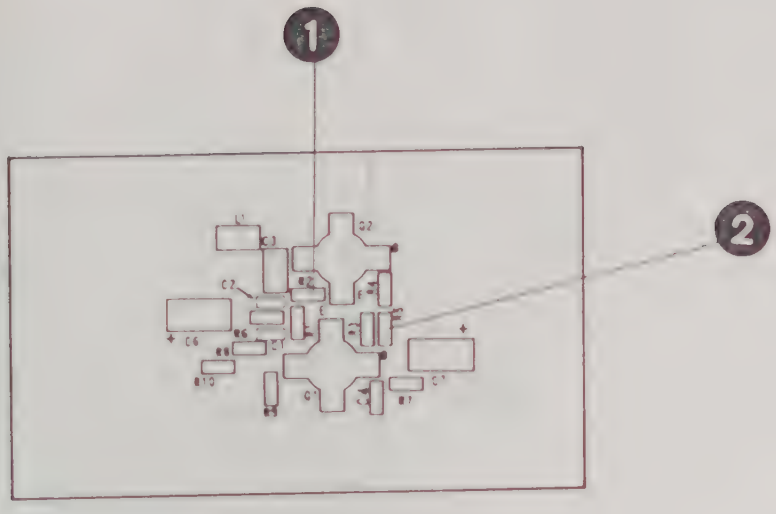


Fig. 3-18 A8-A1 LD DRIVER-1 PC Board Parts Layout-Rear Side (MH951A, MH952A) 8

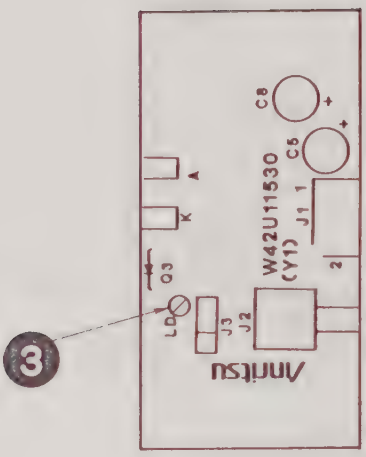


Fig. 3-19 A8-A1 LD DRIVER-1 PC Board
Parts Layout-Front Side
(MH958A/MH968A) 8

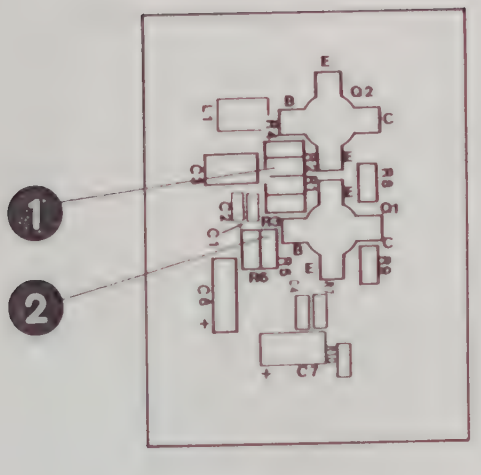


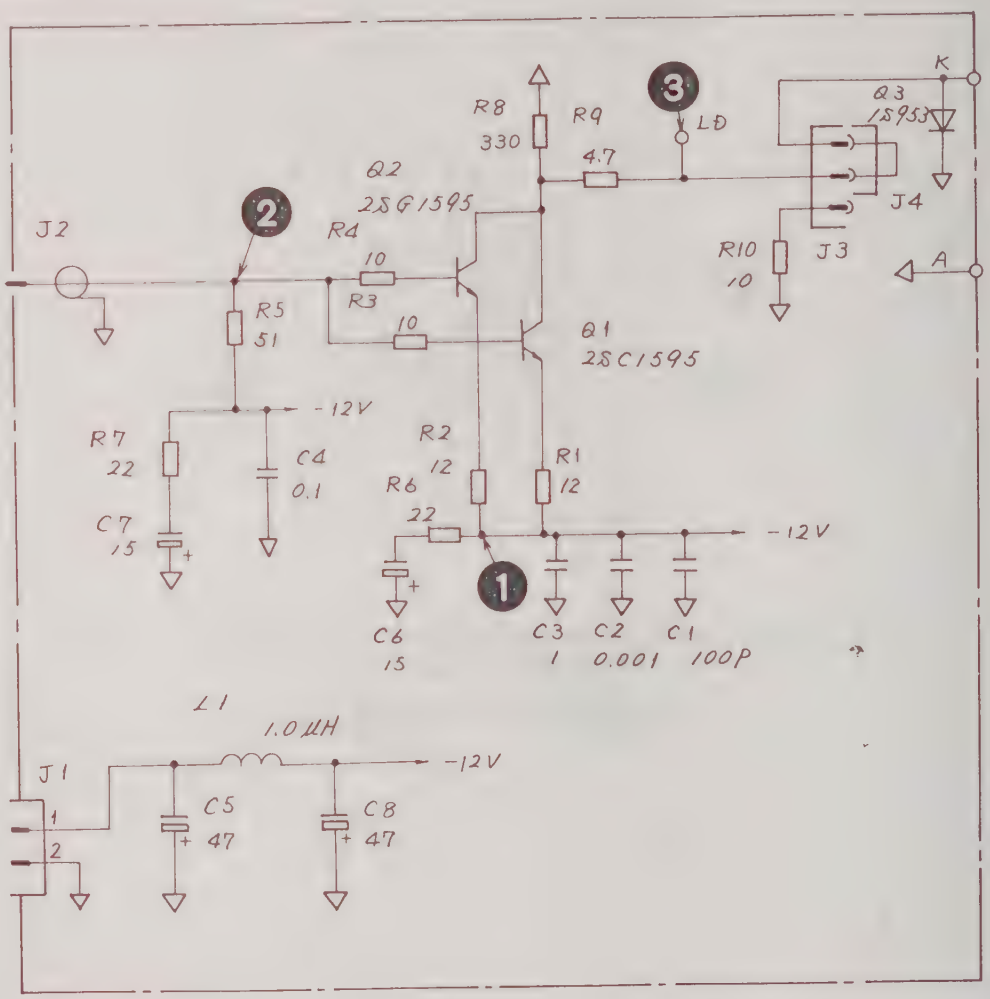
Fig. 3-20 A8-A1 LD DRIVER-1 PC Board Parts Layout Rear Side

(MH958A/MH968A) 8

W4W11075 1/1

APPLICATION

REVISIONS



Parts List	W4W11080

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH

8

CHECKED BY	TRACED BY	SCALE
APPROVED BY	DRAWN BY	:

DEP

TITLE LD DRIVER(A8-A1, MH951A/MH952A/MH958A/MH968A) Circuit Diagram

DRAWING No. W4W11075 1/1

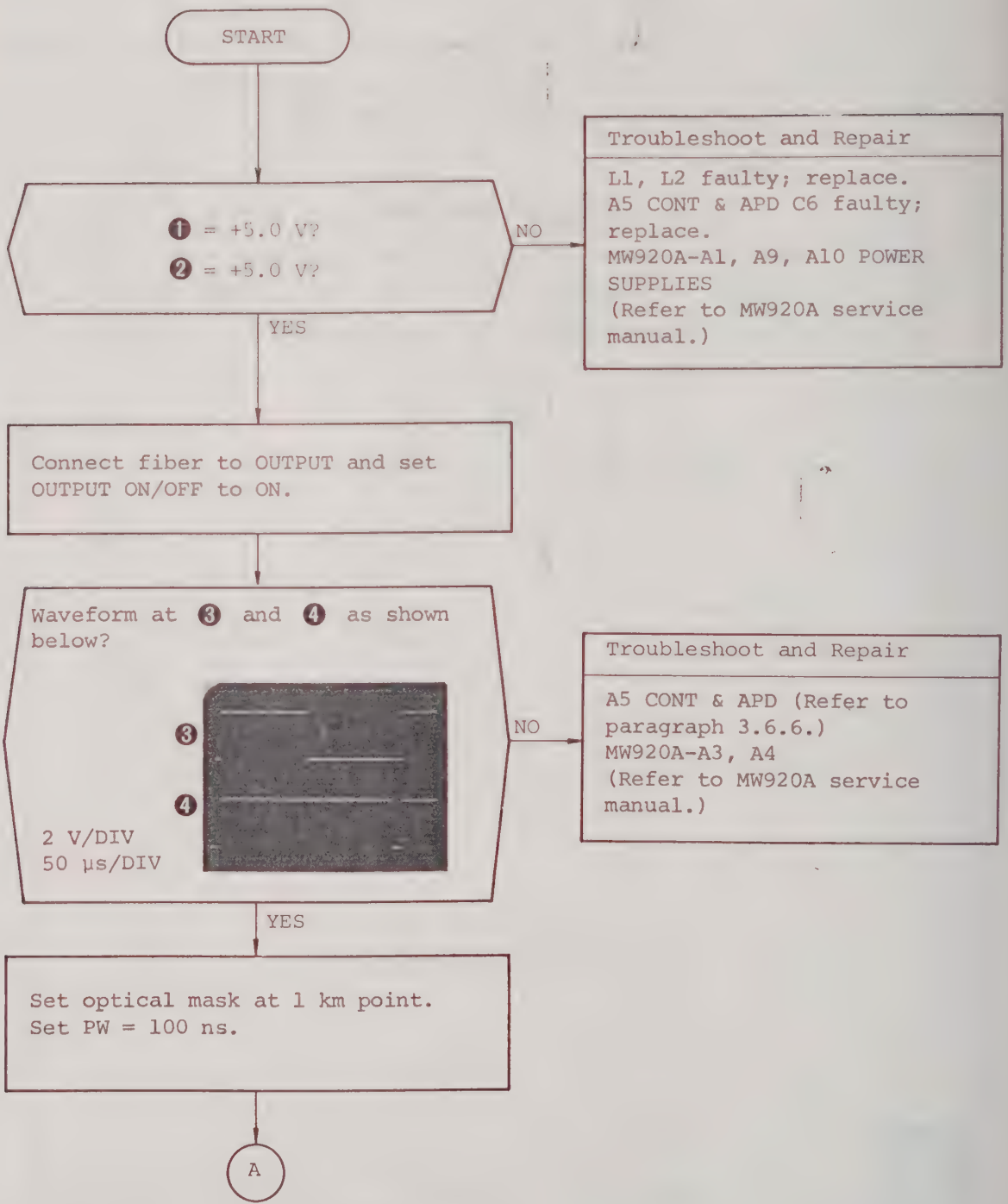
3.6.9 A6 AO TIMING 9

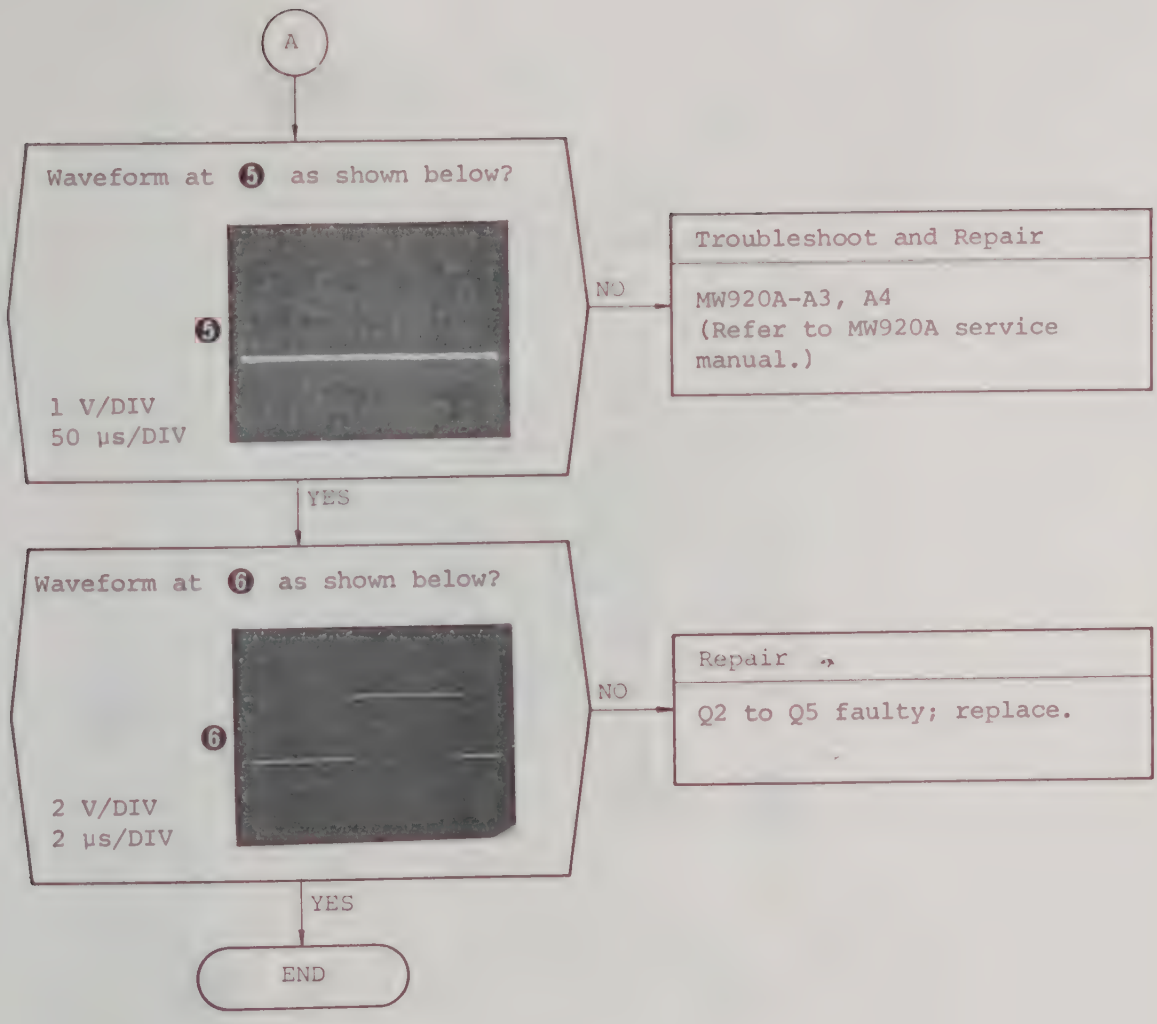
(1) Circuit description

This PC board generates a signal that controls the AO switch ON/OFF function. This PC board is installed in the MH958A/MH968A which has a built-in AO switch.

This PC board uses the optical pulse mask trigger and the one-point screen mask trigger emitted from the MW920A to generate an AO control signal at Q2 and Q3. This control signal is supplied to A7 AO DRIVER.

(2) Troubleshooting and repair




A
Waveform at ❺ as shown below?
❺
1 V/DIV
50 µs/DIV
NO
Troubleshoot and Repair
MW920A-A3, A4
(Refer to MW920A service manual.)
YES
Waveform at ❻ as shown below?
❻
2 V/DIV
2 µs/DIV
NO
Repair
Q2 to Q5 faulty; replace.
YES
END

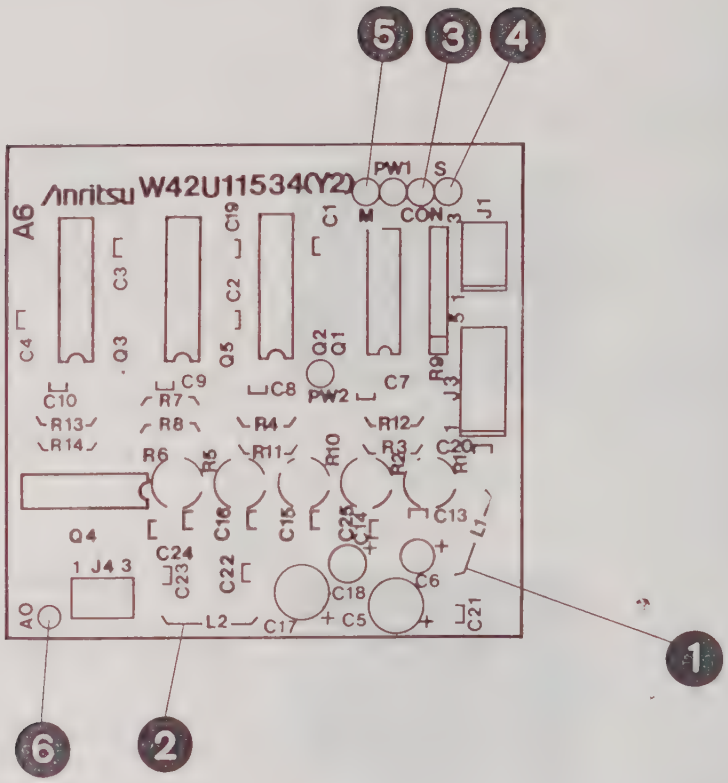
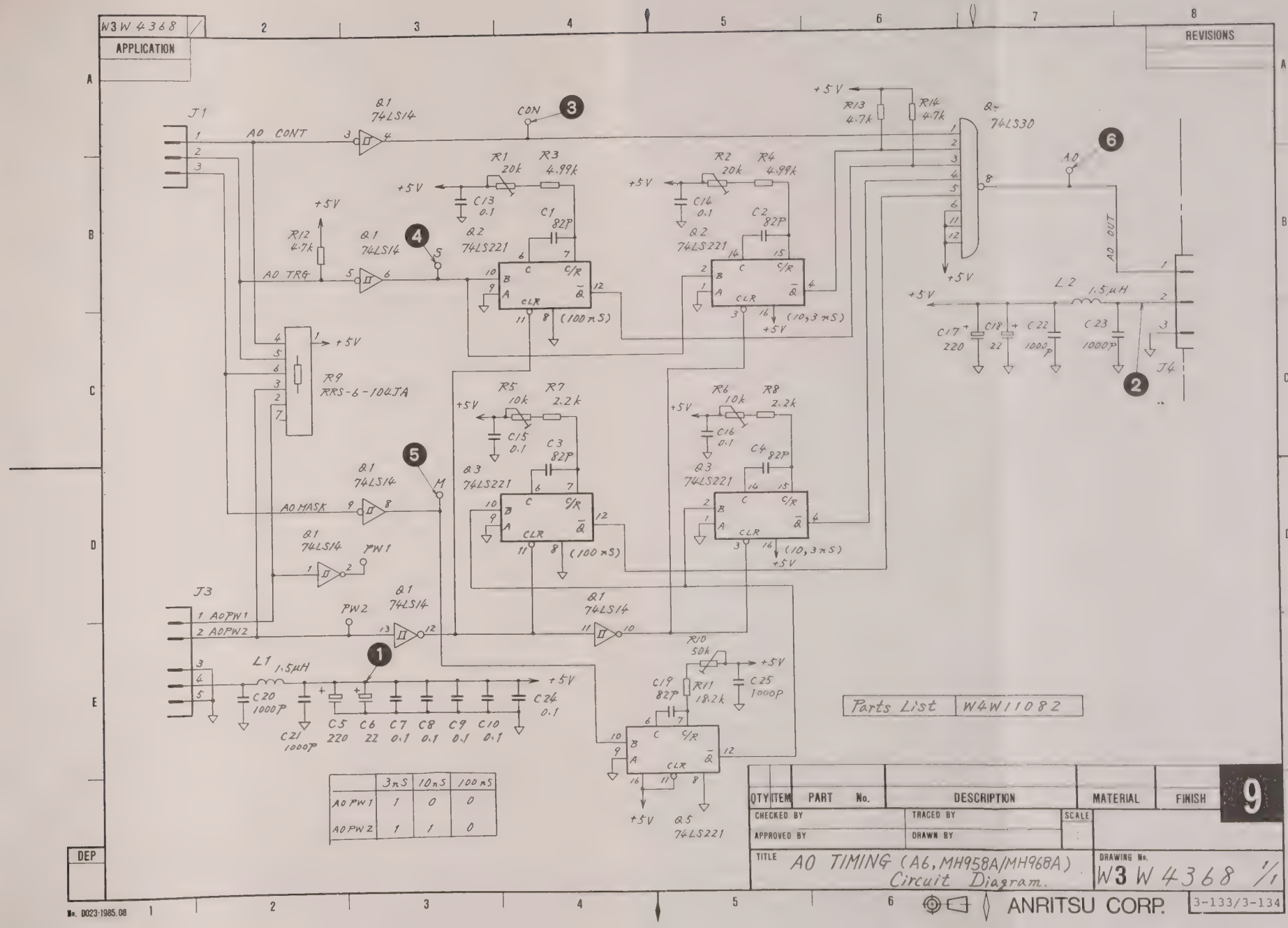


Fig. 3-21 A6 AO TIMING PC Board Parts Layout (MH958A/MH968A)


W3W4368
APPLICATION
REVISIONS
A0 CONT
A0 TRG
A0 MASK
PW1
PW2
A0PW1
A0PW2
CON
A0
A0 OUT
+5V
(100nS)
(10,3nS)
(100nS)
(10,3nS)
R9 RRS-6-104JA
L1 1.5μH
L2 1.5μH
Q1 74LS14
Q2 74LS221
Q3 74LS221
Q4 74LS30
Q5 74LS221
J1
J3
J4
Parts List W4W11082
3nS 10nS 100nS
A0 PW1 1 0 0
A0 PW2 1 1 0
QTY ITEM PART No. DESCRIPTION MATERIAL FINISH
CHECKED BY
APPROVED BY
TRACED BY
DRAWN BY
SCALE
TITLE A0 TIMING (A6, MH958A/MH968A) Circuit Diagram.
DRAWING No. W3W4368 1/1
DEP
ANRITSU CORP.
No. 0023-1985.08
3-133/3-134

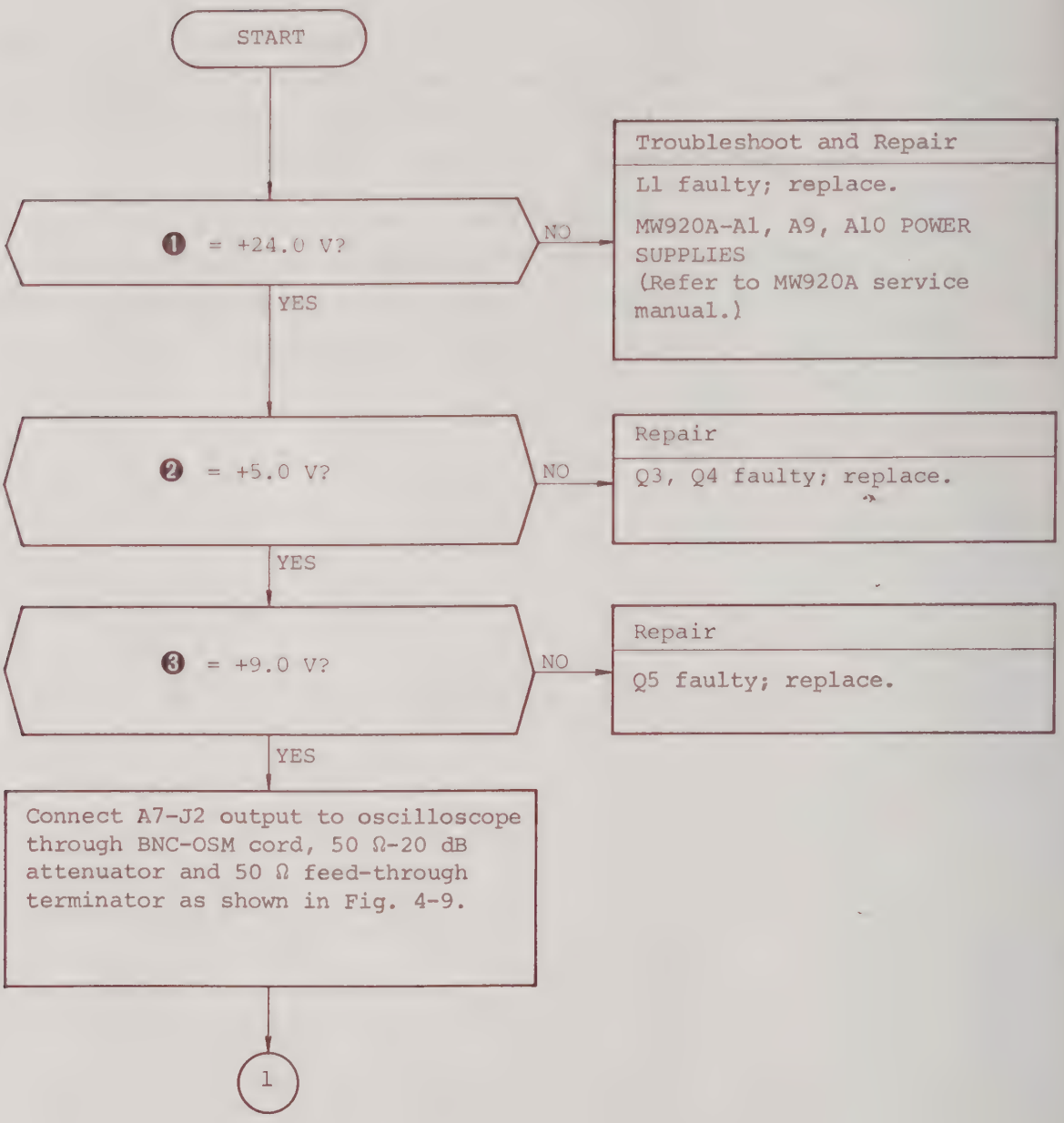
3.6.10 A7 AO DRIVER 10

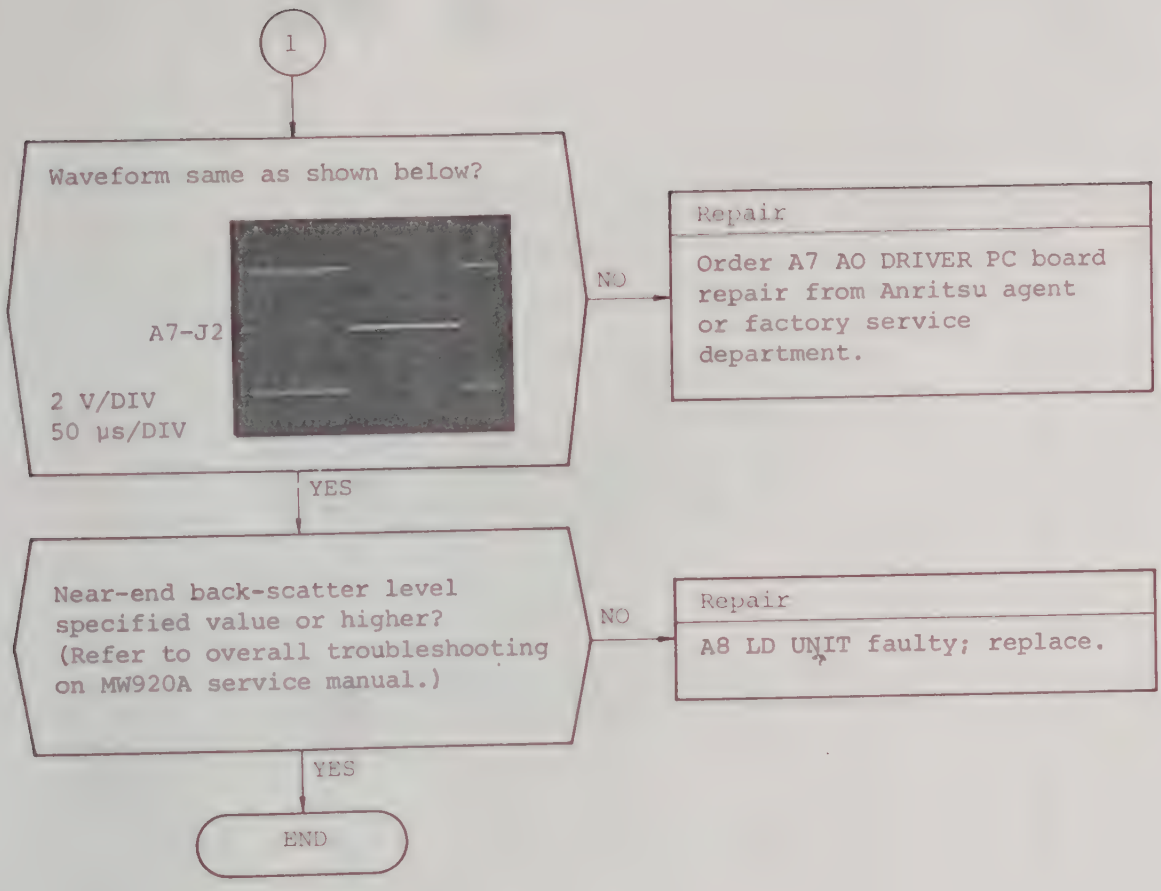
(1) Circuit description

The circuit that drives the AO switch built into the A8 LD UNIT is installed in this PC board and this PC board is installed in the MH958A/MH968A which uses the MASK function with the AO switch.

The signal from the crystal oscillator Z1 and the control singal from A6 AO TIMING are mixed in mixer A7-Z2 to obtain the burst signal required for the MASK signal. This burst signal is amplified at Q6 and Q7 and is output.

(2) Troubleshooting and repair




1
Waveform same as shown below?
A7-J2
2 V/DIV
50 µs/DIV
NO
Repair
Order A7 AO DRIVER PC board repair from Anritsu agent or factory service department.
YES
Near-end back-scatter level specified value or higher? (Refer to overall troubleshooting on MW920A service manual.)
NO
Repair
A8 LD UNIT faulty; replace.
YES
END

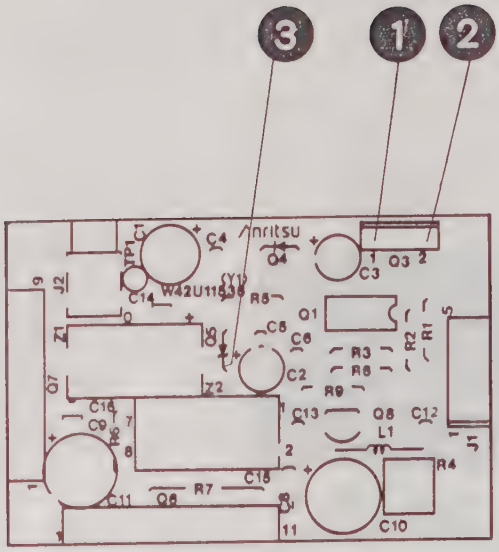
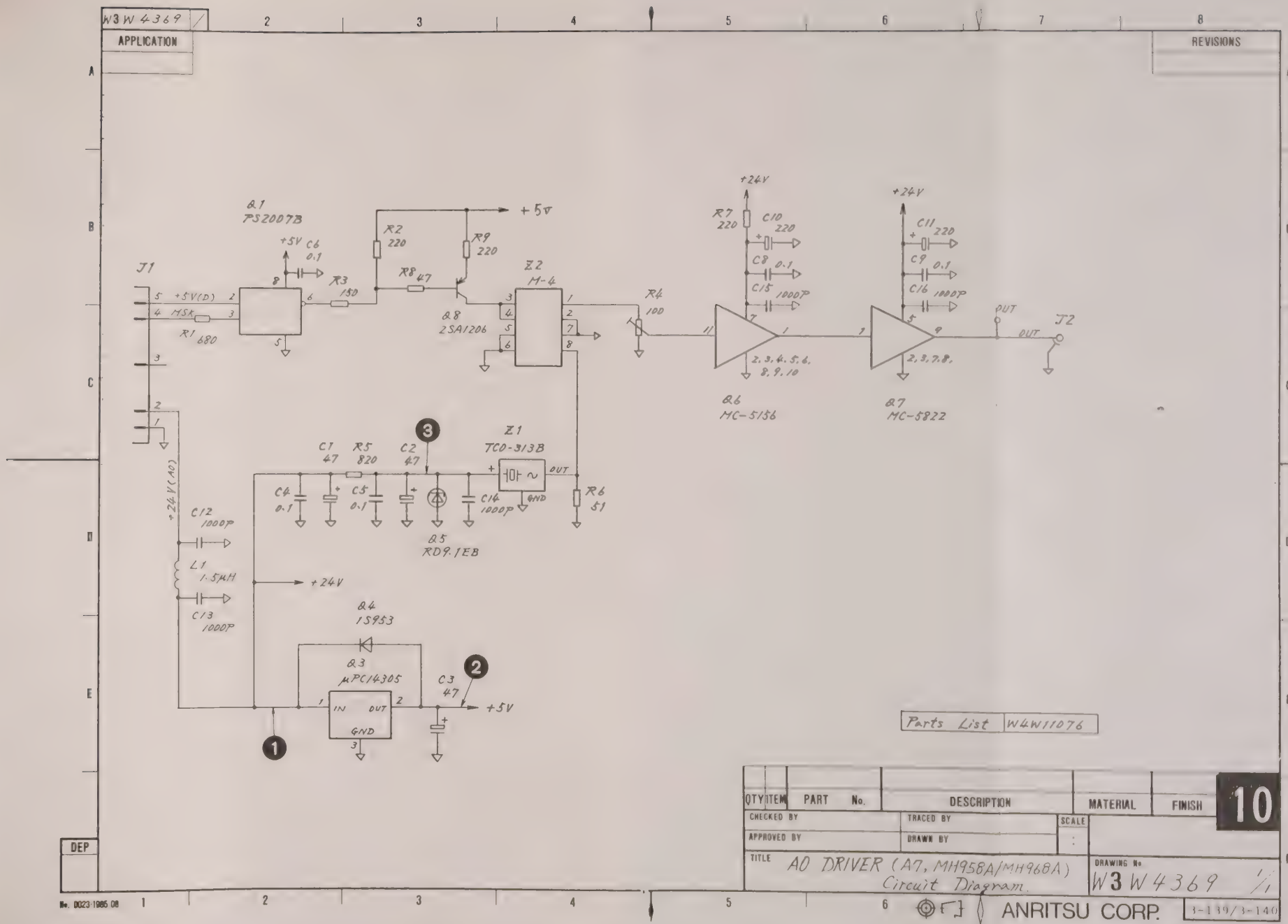


Fig. 3-22 A7 AO DRIVER PC Board Parts Layout (MH958A) 10


W3W4369
APPLICATION
REVISIONS
Q1
PS2007B
+5V
C6
0.1
J1
+5V(D)
MSR
R1
680
R3
150
R2
220
R9
220
R8
47
Q8
2SA1206
Z2
M-4
R4
100
+24V
R7
220
C10
220
C8
0.1
C15
1000P
2.3.4.5.6.
8.9.10
Q6
MC-5156
C11
220
C9
0.1
C16
1000P
2.3.7.8.
Q7
MC-5822
OUT
J2
C1
47
R5
820
C2
47
Z1
TCO-313B
OUT
GND
C4
0.1
C5
0.1
C14
1000P
R6
51
Q5
RD9.1EB
+24V(A0)
C12
1000P
L1
1.5μH
C13
1000P
+24V
Q4
1S953
Q3
μPC14305
IN
OUT
GND
C3
47
+5V
Parts List
W4W11076
QTY
ITEM
PART No.
DESCRIPTION
MATERIAL
FINISH
10
CHECKED BY
TRACED BY
SCALE
APPROVED BY
DRAWN BY
TITLE
A0 DRIVER (A7, MH958A/MH968A)
Circuit Diagram.
DRAWING No.
W3W4369
1/1
DEP
ANRITSU CORP.
3-139/3-140

SECTION 4

ADJUSTMENT

4.1 Adjustment Sequence

This section describes how to adjust the MH951A/ MH952A/MH958A/MH968A plug-in units after repair.

When making adjustments, connect the plug-in unit to the MW920A with the extender cable as shown in Table 3-3.

The plug-in unit adjustment points, step sequence and the contents are summarized in Table 4-1.

If this step sequence is reversed, previous adjustments may be altered.

The required equipment is the same as the recommended test equipment in Table 3-2.

Table 4-1 Adjustment Steps, Points, and Contents

Step	PC Board	Adjustment Point	Required Equipment	Adjustment Contents (associated paragraph)
1	A2-A1 I/V CONV	A2-A1-R5 R9 (MH951A, MH952A only)	. Oscilloscope	Offset bias adjustment (Paragraph 4.2.1.)
	A5 CONT & APD	A5-R45 R46		

Table 4-1 Adjustment Steps, Points, and Contents (Cont.)

Step	PC Board	Adjustment Point	Required Equipment	Adjustment Contents (associated paragraph)
2	A1 AMP	A1-R43 R63 R65 R66 R67 R71 (MH951A, MH958A, MH968A) R73 R74 R75 R78 R79 R80 R81 R82	. Oscillscope	Offset bias adjustment (Paragraph 4.2.2)
3	A5 CONT & APD	A5-R45 R46 R47	. Digital multimeter . Oscilloscope . Optical attenuator . Optical fiber cable 2 . Stabilized light source . Coaxial cord	APD bias adjustment (Paragraph 4.2.3)
4	A3 LD DRIVER-2	A3-R35 (MH951A, MH952A) R52	. Oscilloscope . Optical fiber cable 3	LD drive current (MH951A, MH952A only) LD drive timing adjustments (Paragraph 4.2.4)
5	A1 AMP	A1-R63 R64 (MH952A R65 R66 R67	. Oscilloscope . Optical fiber cable 2	Limit bias adjustment (MH951A, MH952A only) (Paragraph 4.2.5)

Table 4-1 Adjustment Steps, Points, and Contents (Cont.)

Step	PC Board	Adjustment Point	Required Equipment	Adjustment Contents (associated paragraph)
6	A7 AO DRIVER	A7-R4	. Oscilloscope . 50 Ω feed-through terminator . 20 dB electronic attenuator . BNC-OSM cord	AO drive voltage adjustment (MH958A, MH968A) (Paragraph 4.2.6)
7	A6 AO TIMING	A6-R1 R2 R5 R6 R10	. Optical fiber cable 1	AO drive timing adjustment (MH958A, MH968A) (Paragraph 4.2.7)

4.2 Adjustment Procedure

4.2.1 A2-A1 I/V CONV 4

The A2-A1 I/V CONV adjustment adjusts the offset bias.

Step	Procedure
1	Confirm that A2-A1-J1 and A5-J6 are connected as shown in 1.
2	Confirm that A5-R45 and R46 are at their minimum values.
3	Confirm that the APD is installed between pins A and K and the thermistor is installed between pins THG and TH.
4	Adjust R9 to the position shown below (MH951A and MH952A only).

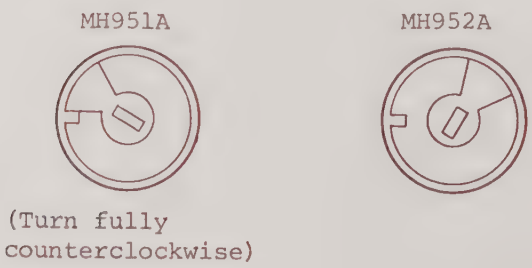


Fig. 4-1 Offset Bias Adjustment Variable Resistor R9

5	Measure the voltage at Q1-pin 12 with an oscilloscope and adjust R5 so that the reading is 0.0 V.

4.2.2 A1 AMP ❷ (Offset bias adjustment)

The A1 AMP adjustment adjusts the offset bias.

Step	Procedure
1	Turn R63, R65, R66, and R67 fully clockwise.
2	While pressing the [GP-IB] key, turn the POWER ON to set the OFFSET CONTROL mode (software for adjustment).
3	Confirm that OFFSET CONTROL is displayed.
4	Confirm with a digital voltmeter that the points are set to the following voltages. Point .... Set Voltage ❷ .... +12.0 ±0.5 V ❸ .... -12.0 ±0.5 V ❶ .... +5.0 ±0.5 V
5	Remove the pins shorting the following connectors. MH951A: J6 and J8 MH952A: J8 MH958A: J8 MH968A: J8 Leave the MW920A in the OFFSET CONTROL mode.
6	Display TUNE OFFSET 128 with the ADVANCED FUNCTION [SELECT] key.

(continued)

Step	Procedure
	(a) OFFSET adjustment
7	Display TUNE OFFSET 0 with the rotary knob.
8	Connect a digital voltmeter to checkpoint E6 (⓮ for MH951A/MH958A/MH968A, ⓯ for MH952A) and adjust R79 so that the reading is -2.00 ±0.01 V.
	(b) GAIN adjustment
9	Display TUNE OFFSET 255 with the rotary knob.
10	Connect a digital voltmeter to checkpoint E6 and adjust R78 so that the reading is +2.00 ±0.01 V.
11	Display TUNE OFFSET 128 and confirm that the digital voltmeter reading is approximately 0.0 V. Then connect J8.
12	With an oscilloscope connected to checkpoint 1 ❻, confirm that it reads approximately 0.0 V.
13	With an oscilloscope connected to each checkpoint listed in Table 4-2, adjust the adjustment variable resistor so that the reading is 0.0 V.

(continued)

Step	Procedure
13 (cont.)	Table 4-2 A1 GAIN Adjustment

MH951A		MH952A		MH958A		MH968A	
Check point	Adjustment variable resistor	Check point	Adjustment variable resistor	Check point	Adjustment variable resistor	Check point	Adjustment variable resistor
❼	R71	—	—	—	—	—	—
❾	R73	❾	R73	❼	R71	❼	R71
❿	R74	❿	R74	❾	R73	❾	R73
⓫	R75	⓫	R75	❿	R74	❿	R74
⓬	R80	⓬	R80	⓫	R75	⓫	R75
⓭	R81	⓭	R81	⓬	R80	⓬	R80
❽	R82	❽	R82	⓭	R81	⓭	R81
—	—	—	—	❽	R82	❽	R82

4.2.3 A5 CONT and APD 6

This A5 CONT and APD adjustment adjusts the APD bias.

(1) Setup

Step	Procedure
1	Obtain the synchronizing signal from the 27 DP type connector inside the MW920A printer cover, input the signal to the modulation input terminal of the Pulse Generator (PG) light source to generate a synchronizing signal (waveform duty factor 50%) that is converted to optical signal.
2	Setup as shown in Fig. 4-2.

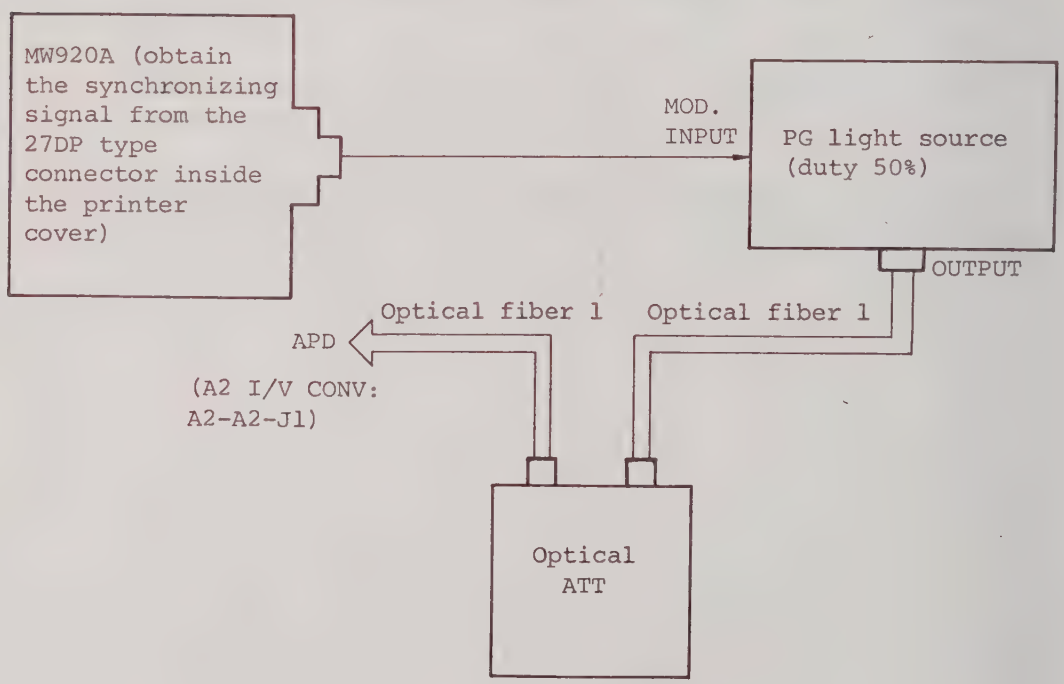


Fig. 4-2 APD Bias Adjustment Setup

(continued)

Step	Procedure
2 (cont.)	Note: Change the PG light source wavelength λ or optical ATT type according to the plug-in unit.

Plug-in Unit	Fiber	Wavelength (μm)
MH951A	GI	0.85
MH952A	GI	1.30
MH958A	SM	1.30
MH968A	SM	1.55

(2) Adjustment

Step	Procedure
1	Adjust R47 so that the voltage at checkpoint T2 with reference to checkpoint T3 is +10 V.
2	Rotate A5-R45 and R46 fully counterclockwise.
3	Check that the following pulse waveform appears at A1-E1 ❼ . Set an oscilloscope to 2 mV/DIV, and adjust the optical ATT until the peak-to-peak level value on the oscilloscope is 1 division (2 mVp-p) (for the MH951A, it is noisy).

Fig. 4-3 A1-E1 ❼ (MH952A) Waveform

4	Increase the optical ATT by 10 dB while maintaining the status of step 2. While observing the pulse waveform on A1-E1, adjust R45 and R46 until the pulse waveform peak-to-peak level value for the MH951A is 3 divisions (6 mVp-p). Similarly adjust R45 and R46 until the pulse waveform peak-to-peak level value for the MH952A and MH958A is 2 divisions (4 mVp-p). R45 --- Coarse adjustment R46 --- Fine adjustment

(continued)

Step	Procedure
4 (cont.)	Since the MH952A has a long time-constant, adjustment of R45 and R46 must be repeated after the value indicated by the digital voltmeter, which is connected to the checkpoint APDB (A5- ⓯), stabilizes. Be careful of electric shocks because the VB voltage ⓯ of the MH952A is approximately 200 V.

4.2.4 A3 LD DRIVER-2 5

This A3 LD DRIVER-2 adjustment, adjusts the LD driver current and LD driver timing.

(1) LD driver current adjustment - MH951A/MH952A only

Step	Procedure
1	Change the A8-A1 J4 connection to the R10 side.
2	Set the MW920A ATT to OFF, and adjust R35 to make the pulse waveform at J4 4.0 Vp-p (Use an oscilloscope).

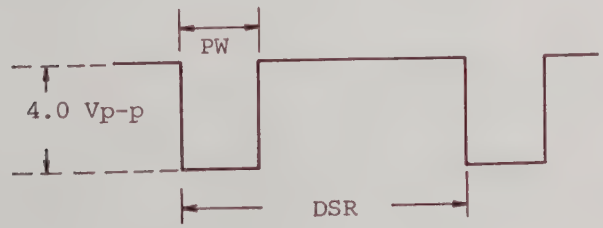


Fig. 4-4 Waveform at J4 (ATT OFF)

(continued)

Step	Procedure
3	Set the ATT to ON and adjust R35 to make the pulse waveform at J4 1.0 Vp-p.

Note:

Set the ATT to ON or OFF as follows:

(i) Press the ADVANCED FUNCTION [SELECT] key to display ATT OFF.

(ii) Then press the [SET] key to set the ATT to ON or OFF.

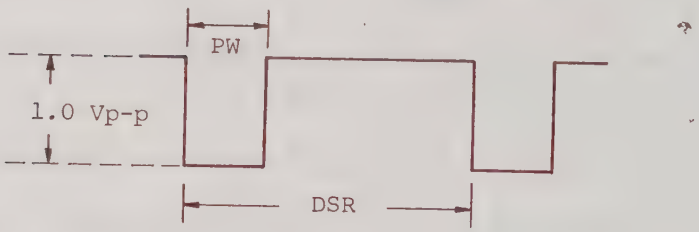


Fig. 4-5 Waveform at J4 (ATT ON)

(2) LD driver timing adjustment

Step	Procedure
1	Cover the A1 AMP and A2 I/V CONV. Then cover the external case.
2	Insert the plug-in unit to the MW920A.
3	Set the POWER to ON. Then set the MW920A as follows: DR: 15 km PW: 3 ns V-SCALE: 5 m/DIV H-SCALE: 0.5 dB/DIV ATT: OFF
4	Obliquely polish one end of an optical fiber cable 3 of known length (about 10 km) and paint the end with matching jelly before connecting it. Then set the LASER OUTPUT to ON.
5	Set the marker to the same distance as the optical fiber cable 3 length.
6	Set AVERAGE to ON and adjust R52 to match the point of the Fresnel reflection to the same position as the marker while confirming the position. Moves to the + side (right) when R52 turned clockwise. Moves to the - side (left) when R52 turned counterclockwise.

4.2.5 A1 AMP 2 (Limit bias adjustment) - MH951A/MH952A only

The A1 AMP adjustment adjusts the limit bias (output level limit).

(1) Preparation

Step	Procedure
1	Confirm that the variable resistors R63, R65, R66, and R67 are turned clockwise fully.
2	Connect the optical fiber cable 4 (approximately 1 to 2 km in length with a high reflection level) to the input connector section. Do not use matching jelly because high reflection is required.
3	Set the MW920A as follows: PW: 100 ns ATT: OFF LASER: ON

(2) Adjustment for MH951A

Step	Procedure
1	Monitor checkpoint 1 (A1- ❻) with an oscilloscope. Turn R63 fully clockwise and confirm that the waveform peak-to-peak level value is minimum.
2	Monitor checkpoint 3 (A1- ❼) with an oscilloscope. Turn R65 fully clockwise and confirm that the waveform peak-to-peak level value is minimum.
3	Monitor checkpoint 4 (A1- ⓬) with an oscilloscope. Turn R66 fully clockwise and confirm that the waveform peak-to-peak level value is minimum.
4	Monitor checkpoint 5 (A1- ⓭) with an oscilloscope and adjust R67 so that the waveform peak-to-peak level value is 1.5 V.

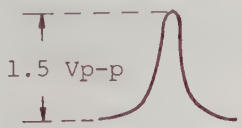


Fig. 4-6 Checkpoint 5 (A1- ⓭) Waveform

5	At the end of the adjustment, monitor checkpoint 6 (A1- ❽) with an oscilloscope and confirm that the noise level is approximately 1 to 2 Vp-p.

(3) Adjustment for MH952A

Step	Procedure
1	Monitor checkpoint 1 (A1- ❻) with an oscilloscope. Turn R63 fully clockwise and confirm that the waveform peak-to-peak level value is minimum.
2	Monitor checkpoint 2 (A1- ⓮) with an oscilloscope. Turn R14 fully clockwise and confirm that the waveform peak-to-peak level value is minimum.
3	Monitor checkpoint E1 (A1- ❼) with an oscilloscope and adjust R65 so that the waveform peak-to-peak level value is 1.0 V.

Fig. 4-7 Checkpoint E1 (A1- ❼) Waveform

4	Monitor checkpoint 4 (A1- ⓬) with an oscilloscope and adjust R66 so that the waveform peak-to-peak level value is 1.0 V.

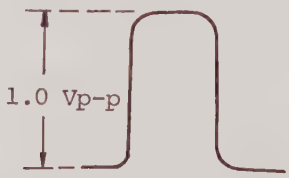


Fig. 4-8 Checkpoint 4 (A1- ⓬) Waveform

(continued)

Step	Procedure
5	Monitor checkpoint 5 (A1- ⓭) with an oscilloscope and adjust R67 so that the waveform peak-to-peak level value is 1.5 V.
6	At the end of the adjustment, monitor checkpoint 6 (A1- ❽) with an oscilloscope and confirm that the noise level is approximately 1 to 2 Vp-p.

4.2.6 A7 AO DRIVER 10 - MH958A/MH968A

The AO driver adjustment adjusts the AO driver voltage.

(1) Setup

Connect the A7-J2 output to oscilloscope through the BNC-OSM cord, 50 Ω - 20 dB attenuator, and 50 Ω feed-through terminator as shown in Fig. 4-9

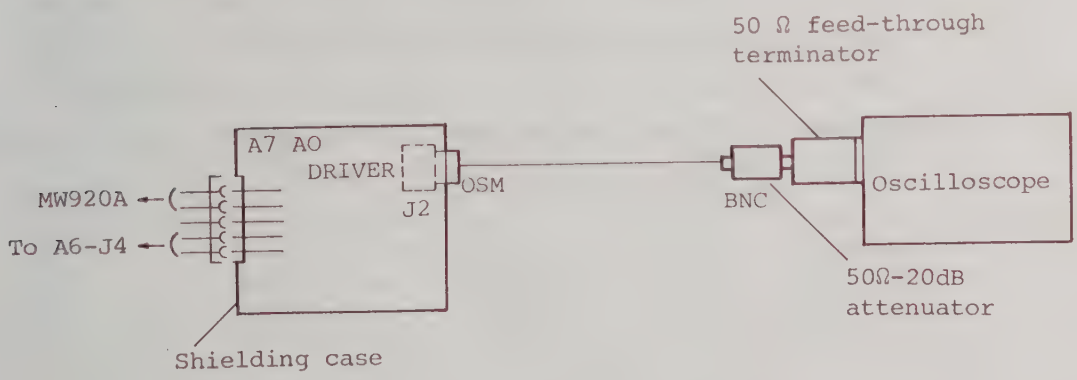


Fig. 4-9 A7 Troubleshooting and Adjustment Setup

(2) Adjustment

Step	Procedure
1	Adjust R4 so that the 0-peak level value of the pulse waveform observed with an oscilloscope is the voltage marked on top of the module.

4.2.7 A6 AO TIMING 9 - MH958A/MH968A

The A6 AO TIMING adjusment adjusts the AO driver timing.

Step	Procedure
1	Connect the Optical fiber cable 1 to the OUTPUT connector.
2	Set OUTPUT to ON and expand the near-end trace.
3	Adjust the mask distance corresponding to the set pulse width with each variable resistor to obtain the CRT display shown in Fig. 4-10. The mask distance at each pulse width and adjustment variable resistors are listed in Table 4-2.

Step	Procedure

3
(cont.)

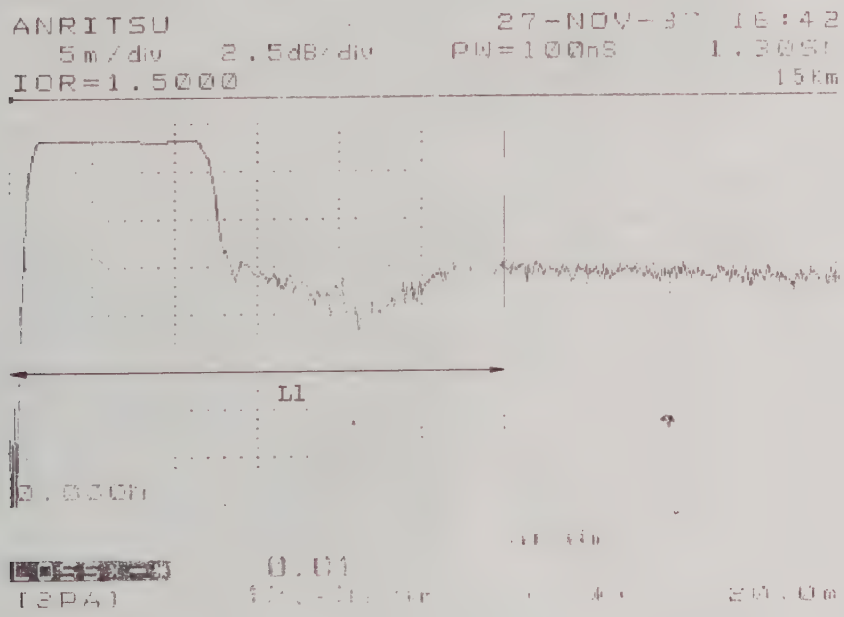


Fig. 4-10 Near-end Mask Distance L1

Table 4-2 Mask Distance L1 and Adjustment Variable Resistor Corresponding to Each Pulse Width

Set Pulse Width	Mask Distance L1	Adjustment Variable Resistor
100 ns	30 m	R1
10 ns	15 m	R2
3 ns	—	—

(continued)

Step	Procedure
4	Set the horizontal scale to 5 m/DIV with the [H-SCALE] key.
5	Adjust each variable resistor and set the mask width corresponding to the set pulse width (shown in Fig. 4-11) to the value shown in Table 4-3.

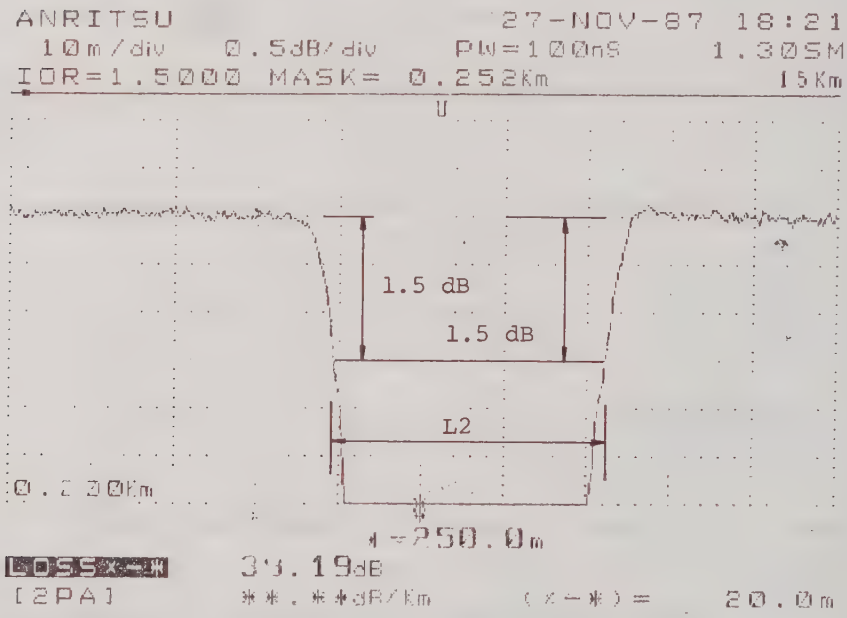


Fig. 4-11 Mask Width L2

Table 4-3 Mask Width and Adjustment Variable Resistor Corresponding to the Set Pulse Width

Set Pulse Width	Mask Width L1	Adjustment Variable Resistor
100 ns	33 m	R5
10 ns	22 m	R6
3 ns	—	—

(continued)

Step	Procedure
6	Adjust the masked positions at 1.5 dB with variable resistors R10. Note: Correct adjustment can be made by 2PA mode with X and * markers as shown in Fig. 4-12.

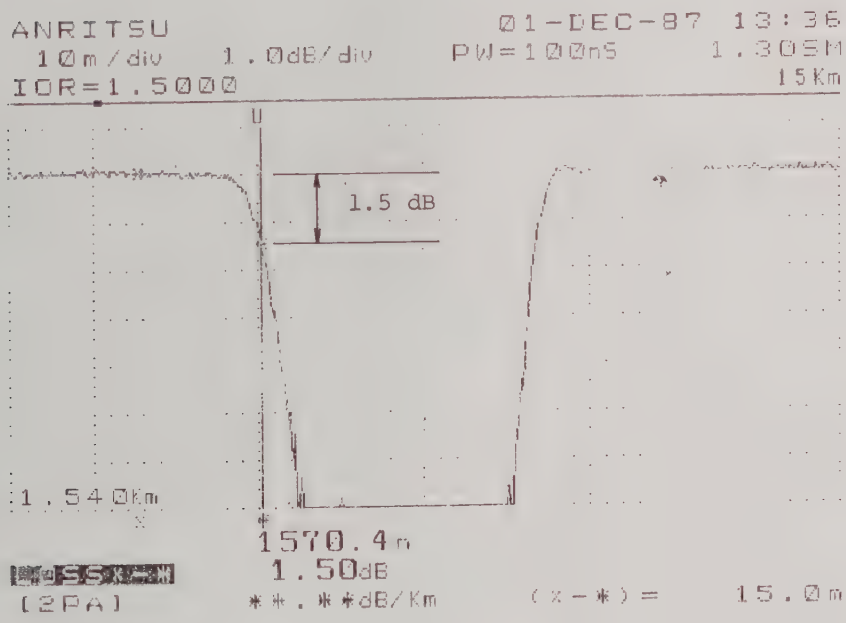


Fig. 4-12 Adjustment of the Arbitrary Mask Position

SECTION 5

REPLACEABLE PARTS

5.1 Introduction

This section describes how to order replacement parts. The following table shows circuit references (CKT REF) and abbreviations used for items in the Parts Lists. The quantity of each item in the Parts List is "one" unless another value is given in the "NOTE" column.

(1) Circuit references

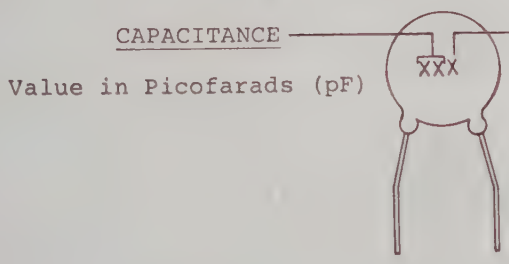
AT:	Attenuator	K:	Relay	Q:	Transistor, diode, IC, rectifier	V:	Neon lamp, vacuum tube
C:	Capacitor	L:	Coil, microinductor	R:	Resistor	X:	Crystal OSC
F:	Fuse	M:	Meter, timer	S:	Switch	Z:	Unit
J:	Jack, plug, connector	P:	Lamp	T:	Transformer		

(2) Abbreviations

A:	amperes	Multi:	multiplying
Att, R var:	variable attenuator using film elements	N-ch:	N-channel
BL:	boundary layer	non-lin:	non-linear taper
Cer:	ceramic	Non-pol:	non polarity
CF:	carbon film	NPN:	negative-positive-negative
Comp:	composition	Ω:	ohms
CRT:	cathode-ray tube	p:	pico (x 10^{-12})
Di:	diode	Plast:	plastic film
DIP:	dual in-line package	PMTR:	potentiometer
Elect:	electrolytic aluminum	PNP:	positive-negative-positive
F:	farad	p-p:	peak-to-peak value
FET:	field-effect transistor	RFC:	RF choke
G:	ground	R-lamp:	resistor lamp
Ge:	germanium	rms:	effective value (root-mean-square)
H:	henry	SBD:	Schottky barrier diode
Hz:	hertz	SCR:	silicon-controlled rectifier
IC:	integrated circuit	Si:	silicon
IEC:	Conforms to IEC Safety Standards.	SRD:	step-recovery diode
J-FET:	junction FET	Tant:	tantalum
k:	kilo (x 10^{3})	TM:	time-lag
LED:	light-emitting diode	Tr:	transistor
M:	mega (x 10^{6})	Trans:	transformer
m:	milli (x 10^{-3})	μ:	micro (x 10^{-6})
MF:	metallized film	V:	volt
MOS-FET:	metal-oxide semiconductor FET	Var:	variable
M paper:	metallized paper	WW:	wire-wound
M plast:	metallized plastic film	XTAL:	crystal

5.2 Reading Capacitors/Resistors

5.2.1 Capacitor Identification



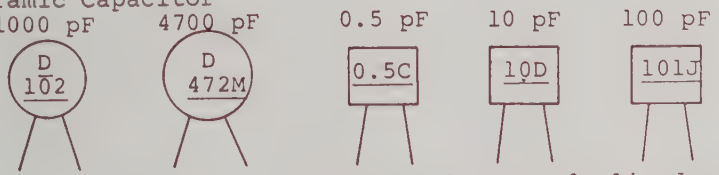
EXAMPLES: 103 = 10,000 pF = 10^{-8} F or 0.01 µF
302 = 3,000 pF = 3×10^{-9} F or 0.003 µF
676 = 67,000,000 pF = 67×10^{-6} F or 67 µF

(a) Ceramic and polyester capacitors

Indication	0.5	1	10	101	102	103	104
Capacity	0.5 pF	1 pF	10 pF	100 pF	1000 pF	0.01 µF	0.1 µF

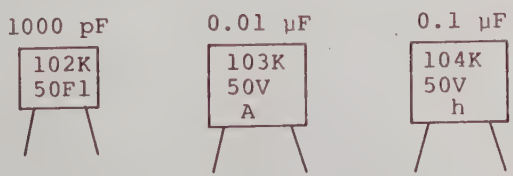
Example:

Ceramic Capacitor



Capacity values are always underlined.

Polyester Capacitor



(b) Tantalum, metallized, and electrolytic capacitors

Indication	OR47	010	100	101
Capacity	0.47 µF	1 µF	10 µF	100 µF

5.2.2 Chip capacitor identification

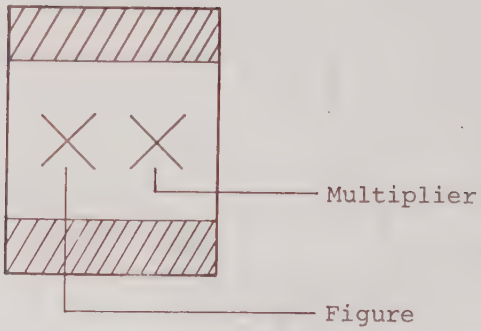
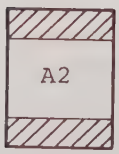


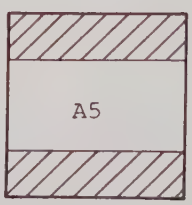
Figure						Multimeter	
Indicated alphabetic character	Corresponding value	Indicated alphabetic character	Corresponding value	Indicated alphabetic character	Corresponding value	Indixated value	Corresponding multiplier
A	1.0	M	3.0	Y	8.2	0	10^0
B	1.1	N	3.3	Z	9.1	1	10^1
C	1.2	P	3.6	a	2.5	2	10^2
D	1.3	Q	3.9	b	3.5	3	10^3
E	1.5	R	4.3	d	4.0	4	10^4
F	1.6	S	4.7	e	4.5	5	10^5
G	1.8	T	5.1	f	5.0	6	10^6
H	2.0	U	5.6	m	6.0	7	10^7
J	2.2	V	6.2	n	7.0	8	10^8
K	2.4	W	6.8	t	8.0	9	10^{-1}
L	2.7	X	7.5	y	9.0		

Examples:



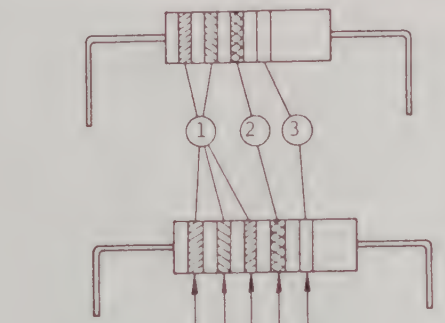
100 pF

8 pF



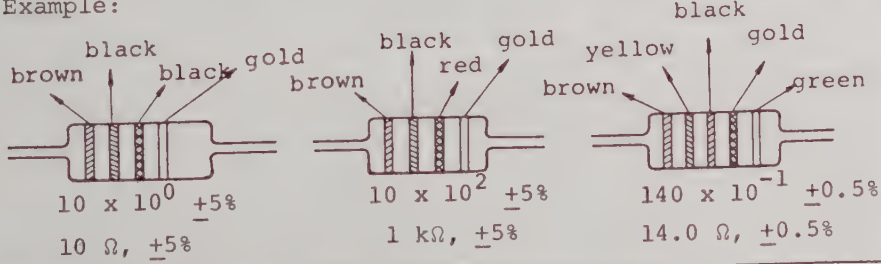
0.1 µF

5.2.3 Resistor identification

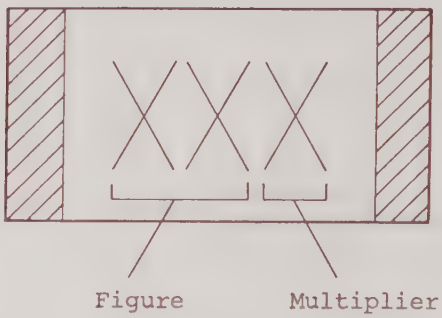


COLOR	① Figure		② Multiplier	③ Tolerance
	1st	2nd	3rd	4th
Black	0	0	$x10^0$	-
Brown	1	1	$x10^1$	-
Red	2	2	$x10^2$	-
Orange	3	3	$x10^3$	-
Yellow	4	4	$x10^4$	-
Green	5	5	$x10^5$	±0.5%
Blue	6	6	$x10^6$	-
Purple	7	7	$x10^7$	-
Gray	8	8	$x10^8$	-
White	9	9	$x10^9$	-
Gold	-	-	$x10^{-1}$	±5%
Silver	-	-	$x10^{-2}$	±10%
-----	-	-		±20%

Example:



5.2.4 Chip resistor identification



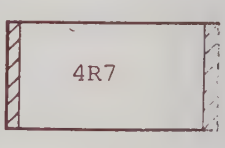
The first two characters are significant digits and the last numeric character indicates the number of zeroes that follow the first two characters.

A decimal point is represented by the character R, and numeric characters are all significant digits in the R representation.

For Examples:

100 Ω

10 kΩ



4.7 Ω

5.3 Ordering Information

When ordering parts, please give the following descriptions by referring to the Parts List.

	Item	Example
(1)	Name of Instrument	MH951A Plug-in Unit
(2)	Name of Parts List	Parts List: A1 AMP
(3)	CKT REF	C3
(4)	Name of Part	SR25VB-220 Note: Part name is given in parentheses ( ) in the Parts List. Parts with asterisk (*) are those that require factory adjustment after repair. When ordering a part or parts with an asterisk, give a full description of the part.
(5)	Quantity	1
(6)	Serial No. of Instrument	M31257

When ordering PC boards with parts mounted, please include the A-number under item (2) above instead of items (3) and (4). (See Table 3-4 for PC board number.)

5.4 Parts List

Table 5-1 Parts List Number

Circuit Diagram No.	Name	A-No.	Parts List No.		
			MH951A	MH952A	MH958A MH968A
1	MH951A/MH952A/MH958A	——	W4W12143	W4W12144	W4W12145
2	AMP	A1	8638	8636	13059
3	RECEIVER	A2	8642	11072	13072
4	I/V CONV	A2-A1	8640	8644	13074
5	LD DRIVER-2	A3	12091	12091	11078
6	CONT & APD	A5	12080	12082	12089
7	LD UNIT	A8	14162	14162	14162
8	LD DRIVER-1	A8-A1	11080	11080	11080
9	AO TIMING	A6	——	——	11082
10	AO DRIVER	A7	——	——	11076

Notes:

1. A6 AO TIMING and A7 AO DRIVER are provided in the MH958A/MH968A.
2. For the PC board number, see Table 3-4.

Parts List: MH951A Plug-in Unit

CKT REF	DESCRIPTION	RATING	NOTE
A 1	AMP PC board		W4WH618
A 2	RECEIVER unit		W4WH642
A 3	LD DRIVER2 PC board		W4W12091
A 4	Not assigned		
A 5	CONT & APD PC board		W4W12080
A 6	Not assigned		
A 7	Not assigned		
A 8	LD UNIT		
J 1	Plug,(DDM-36W4P)	36pins	With DM53740-5000 x 2
J 2	Plug,(27DP-P-196U)		
J 3	Plug,(27DP-P-196U)		
J 4	Jack,(DF1-15S2.5R24)	15pins	
J 5	Jack,(DF1-8S2.5R24)	8pins	
J 6	Not assigned		
J 7	Not assigned		
J 8	Not assigned		
J 9	Not assigned		
J 10	Not assigned		
J 11	Not assigned		
J 12	Not assigned		
J 13	Not assigned		
J 14	Not assigned		
J 15	Jack,(DF1-10S2.5R24)	10pins	
J 16	Jack,(DF1-10S2.5R24)	10pins	
J 17	Jack,(DF1-8S2.5R24)	8pins	
J 18	Jack,(DF1-8S2.5R24)	8pins	
J 19	Plug,(NM11-2F)		
J 20	Plug,(NM11-2F)		
J 21	Not assigned		
J 22	Not assigned		
J 23	Not assigned		
J 24	Not assigned		
J 25	Jack,(DF1-2S2.5R24)	2pins	
J 26	Not assigned		
J 27	Jack,(DF1-2S2.5R24)	2pins	
J 28	Jack,(DF1-2S2.5R24)	2pins	
J 29	Plug,(27DP-LP-1.5-1-201)		
J 30	Plug,(27DP-LP-1.5-1-201)		
J 31	Not assigned		
J 32	Not assigned		
J 33	Not assigned		
J 34	Not assigned		
J 35	Not assigned		
J 36	Not assigned		
S 1	Switch,(SS-5GL)		

( ): Manufacturer's part number
* : Selected at factory

W4W12143 | 1/1

Parts List: MH952A Plug-in Unit

CKT REF	DESCRIPTION	RATING	NOTE
A 1	AMP PC board		W4W8636
A 2	RECEIVER unit		W4W11072
A 3	LD DRIVER2 PC board		W4W12091
A 4	Not assigned		
A 5	CONT & APD PC board		W4W12082
A 6	Not assigned		
A 7	Not assigned		
A 8	LD UNIT		
J 1	Plug,(DDM-36W4P)	36pins	With DM53740-5000 x 2
J 2	Plug,(27DP-P-196U)		
J 3	Plug,(27DP-P-196U)		
J 4	Jack,(DF1-15S2.5R24)	15pins	
J 5	Jack,(DF1-8S2.5R24)	8pins	
J 6	Not assigned		
J 7	Not assigned		
J 8	Not assigned		
J 9	Not assigned		
J 10	Not assigned		
J 11	Not assigned		
J 12	Not assigned		
J 13	Not assigned		
J 14	Not assigned		
J 15	Jack,(DF1-10S2.5R24)	10pins	
J 16	Jack,(DF1-10S2.5R24)	10pins	
J 17	Jack,(DF1-8S2.5R24)	8pins	
J 18	Jack,(DF1-8S2.5R24)	8pins	
J 19	Plug,(NM11-2F)		
J 20	Plug,(NM11-2F)		
J 21	Not assigned		
J 22	Not assigned		
J 23	Not assigned		
J 24	Not assigned		
J 25	Jack,(DF1-2S2.5R24)		
J 26	Not assigned		
J 27	Jack,(DF1-2S2.5R24)		
J 28	Jack,(DF1-2S2.5R24)		
J 29	Not assigned		
J 30	Not assigned		
J 31	Not assigned		
J 32	Not assigned		
J 33	Not assigned		

( ): Manufacturer's part number
* : Selected at factory

W4W12144 | 1/2

Parts List: MH952A Plug-in Unit

CKT REF	DESCRIPTION	RATING	NOTE
J 34	Not assigned		
J 35	Not assigned		
J 36	Not assigned		
S 1	Switch,(SS-5GL)		
W 1	Plug,(27DP-LP-LP)		

( ): Manufacturer's part number
* : Selected at factory

W4W12144 | 2/2

Parts List: MH958A/MH968A Plug-in Unit

CKT REF	DESCRIPTION	RATING	NOTE
A 1	AMP PC board		W4W13059
A 2	RECEIVER unit		W4W13072
A 3	LD DRIVER2 PC board		W4W11078
A 4	Not assigned		
A 5	CONT & APD PC board		W4W12089
A 6	AO TIMING PC board		W4W11082
A 7	AO DRIVER unit		W4W11076
A 8	LD UNIT		
J 1	Plug,(DDM-36W4P)	36pins	With DM53740-5000 x 2
J 2	Plug,(27DP-P-196U)		
J 3	Plug,(27DP-P-196U)		
J 4	Jack,(DF1-15S2.5R24)	15pins	
J 5	Jack,(DF1-8S2.5R24)	8pins	
J 6	Not assigned		
J 7	Not assigned		
J 8	Not assigned		
J 9	Not assigned		
J 10	Not assigned		
J 11	Not assigned		
J 12	Not assigned		
J 13	Not assigned		
J 14	Not assigned		
J 15	Jack,(DF1-10S2.5R24)	10pins	
J 16	Jack,(DF1-10S2.5R24)	10pins	
J 17	Jack,(DF1-8S2.5R24)	8pins	
J 18	Jack,(DF1-8S2.5R24)	8pins	
J 19	Plug,(NM11-2F)		
J 20	Plug,(SMA-LP-85-SF(12))		
J 21	Jack,(DF1-3S2.5R24)	3pins	
J 22	Jack,(DF1-3S2.5R24)	3pins	
J 23	Jack,(DF1-5S2.5R24)	5pins	
J 24	Jack,(DF1-5S2.5R24)	5pins	
J 25	Jack,(DF1-2S2.5R24)	2pins	
J 26	Jack,(DF1-5S2.5R24)	5pins	
J 27	Jack,(DF1-2S2.5R24)	2pins	
J 28	Jack,(DF1-2S2.5R24)	2pins	
J 29	Not assigned		
J 30	Not assigned		
J 31	Plug,(SMA-LP-85-SF(12))		
J 32	Plug,(SMA-LP-85-SF(12))		
J 33	Not assigned		
J 34	Fiber plug,(FC type)		
J 35	Fiber plug,(FC type)		
J 36	Adaptor,(SFCA)		
S 1	Switch,(SS-5GL)		
W 1	Plug,(27DP-LP-LP)		

( ): Manufacturer's part number
* : Selected at factory

W4W12145 | 1/1

Parts List: AMP(A1, MH951A) 2

CKT REF	DESCRIPTION	RATING		NOTE
C 1	Elect,(SR25VB-220)	220μF,±20%,25V		
C 2	Elect,(SR25VB-220)	220μF,±20%,25V		
C 3	Elect,(SR25VB-220)	220μF,±20%,25V		
C 4	Elect,(SR25VB-220)	220μF,±20%,25V		
C 5	Elect,(SR10VB-220)	220μF,±20%,10V		
C 6	Elect,(SR10VB-220)	220μF,±20%,10V		
C 7	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 8	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 9	Elect,(SR25VB-220)	220μF,±20%,25V		
C 10	Elect,(SR25VB-220)	220μF,±20%,25V		
C 11	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 12	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 13	Elect,(SR25VB-100)	100μF,±20%,25V		
C 14	Elect,(SR25VB-100)	100μF,±20%,25V		
C 15	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 16	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 17	Tant,(CS734E1D156M)	15μF,±20%,20V		
C 18	Elect,(SR25VB-100)	100μF,±20%,25V		
C 19	Elect,(SR25VB-100)	100μF,±20%,25V		
C 20	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 21	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 22	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 23	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 24	Elect,(SR25VB-100)	100μF,±20%,25V		
C 25	Elect,(SR25VB-100)	100μF,±20%,25V		
C 26	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 27	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 28	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 29	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 30	Not assigned			
C 31	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 32	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 33	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 34	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 35	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 36	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 37	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 38	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 39	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 40	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 41	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 42	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 43	Elect,(SR25VB-100)	100μF,±20%,25V		
C 44	Elect,(SR25VB-100)	100μF,±20%,25V		
C 45 to C 67	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		

( ): Manufacturer's part number
* : Selected at factory

Parts List: AMP(A1, MH951A)

CKT REF	DESCRIPTION	RATING		NOTE
C 68	Not assigned			
C 69	Not assigned			
C 70	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 71	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 72	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 73	Not assigned			
C 74	Not assigned			
C 75	Not assigned			
C 76	Not assigned			
C 77	Not assigned			
C 78	Cer,(CC732CH1H101J(A2))	100pF,±5%,50V		
C 79	Cer,(CC732CH1H101J(A2))	100pF,±5%,50V		
C 80	Cer,(CC732CH1H101J(A2))	100pF,±5%,50V		
C 81	Cer,(CC733CH1H102J(A3))	1000pF,±5%,50V		
C 82	Not assigned			
C 83	Cer,(CC732CH1H680J(W1))	68pF,±5%,50V		
C 84	Not assigned			
C 85	Not assigned			
C 86	Not assigned			
C 87	Not assigned			
C 88	Not assigned			
C 89	Not assigned			
C 90	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 91	Elect,(SR16VB-22)	22μF,±20%,16V		
C 92	Elect,(SR16VB-22)	22μF,±20%,16V		
C 93	Not assigned			
J 1	Not assigned			
J 2	Plug, (HIF3FB-30PA-2.54DSA)	30pins		
J 3	Not assigned			
J 4	Jack,(27DP-LR-PC)			
J 5	Plug,(FFC-2AMEP)	2pins		
J 6	Jack,(DIC-130)			
J 7	Plug,(FFC-2AMEP)	2pins		
J 8	Jack,(DIC-130)			
J 9	Jack,(HRM300-126S)			
K 1	Not assigned			
K 2	Not assigned			
L 1	Coil,(SN-5-400)	48μH,2A		
L 2	Coil,(SN-5-400)	48μH,2A		

( ): Manufacturer's part number
* : Selected at factory

Parts List: AMP(A1, MH951A)

CKT REF	DESCRIPTION	RATING		NOTE
L 3	Coil,(SN-5-400)	48μH,2A		
L 4	Not assigned			
L 5	Not assigned			
Q 1	IC,(CLC103AI)			
Q 2	Not assigned			
Q 3	IC,(CLC103AI)			
Q 4	IC,(CLC103AI)			
Q 5	IC,(CLC103AI)			
Q 6	IC,(LF356BN)			
Q 7	IC,(LF356BN)			
Q 8	IC,(LF356BN)			
Q 9	IC,(LF356BN)			
Q 10	IC,(μPC624C)			
Q 11	IC,(μPC154C)			
Q 12	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 13	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 14	Not assigned			
Q 15	Not assigned			
Q 16	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 17	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 18	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 19	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 20	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 21	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 22	Not assigned			
Q 23	Not assigned			
Q 24	Di,(1SS99)			
Q 25	Di,(1SS99)			
Q 26	Di,(1SS99)			
Q 27	Di,(1SS99)			
Q 28	Di,(1SS99)			
Q 29	Di,(1SS99)			
Q 30	Not assigned			
Q 31	Not assigned			
Q 32	Not assigned			
Q 33	Not assigned			
Q 34	Di,(1SS99)			
Q 35	Di,(1SS99)			
Q 36	Not assigned			
Q 37	Not assigned			
Q 38	Not assigned			
Q 39	IC,(HI1-201HS-5)			
Q 40	Not assigned			

( ): Manufacturer's part number
* : Selected at factory

Parts List: AMP(A1, MH951A)

CKT REF	DESCRIPTION	RATING		NOTE
Q 41	Not assigned			
Q 42	IC,(74LS123)			
Q 43	IC,(74LS14)			
Q 44	Not assigned			
Q 45	Not assigned			
Q 46	Not assigned			
Q 47	Not assigned			
R 1	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 2	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 3	Not assigned			
R 4	Not assigned			
R 5	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 6	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 7	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 8	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 9	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 10	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 11	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 12	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 13	Not assigned			
R 14	Not assigned			
R 15	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 16	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 17	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 18	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 19	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 20	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 21	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 22	Not assigned			
R 23	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 24	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 25	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 26	CM,(RM73B2B750JD)	75Ω,±5%,1/8W		
R 27	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 28	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 29	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 30	Not assigned			
R 31	Not assigned			
R 32	Not assigned			
R 33	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 34	CM,(RM73B2B104JD)	100kΩ,±5%,1/8W		
R 35	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 36	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 37	CM,(RM73B2B * JD)	0 to 1MΩ,±5%,1/8W		*220kΩ

( ): Manufacturer's part number
* : Selected at factory

Parts List: AMP(A1, MH951A)

CKT REF	DESCRIPTION	RATING	NOTE
R 36	CM,(RM73B2B * JD)	0 to 1MΩ,±5%,1/8W	*: ZK
R 39	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W	
R 40	CM,(RM73B2B272JD)	2.7kΩ,±5%,1/8W	
R 41	CM,(RM73B2B470JD)	47Ω,±5%,1/8W	
R 42	CM,(RM73B2B470JD)	47Ω,±5%,1/8W	
R 43	CM,(RM73B2B222JD)	2.2kΩ,±5%,1/8W	
R 44	CM,(RM73B2B222JD)	2.2kΩ,±5%,1/8W	
R 45	CM,(RM73B2B152JD)	680Ω,±5%,1/8W	
R 46	CM,(RM73B2B750JD)	75Ω,±5%,1/8W	
R 47	CM,(RM73B2B151JD)	150Ω,±5%,1/8W	
R 48	CM,(RM73B2B510JD)	51Ω,±5%,1/8W	
R 49	CM,(RM73B2B470JD)	47Ω,±5%,1/8W	
R 50	CM,(RM73B2B510JD)	51Ω,±5%,1/8W	
R 51	CM,(RM73B2B181JD)	180Ω,±5%,1/8W	
R 52	CM,(RM73B2B470JD)	47Ω,±5%,1/8W	
R 53	Not assigned		
R 54	Not assigned		
R 55	CM,(RM73B2B181JD)	180Ω,±5%,1/8W	
R 56	CM,(RM73B2B510JD)	51Ω,±5%,1/8W	
R 57	CM,(RM73B2B470JD)	47Ω,±5%,1/8W	
R 58	CM,(RM73B2B152JD)	1.5kΩ,±5%,1/8W	
R 59	Not assigned		
R 60	Not assigned		
R 61	CF,(ARD25T153J)	15kΩ,±5%,1/4W	
R 62	Not assigned		
R 63	Var,MF,(RJ-6P 100Ω)	100Ω,1/2W	
R 64	Not assigned		
R 65	Var,MF,(RJ-6P 100Ω)	100Ω,1/2W	
R 66	Var,MF,(RJ-6P 500Ω)	500Ω,1/2W	
R 67	Var,MF,(RJ-6P 500Ω)	500Ω,1/2W	
R 68	Not assigned		
R 69	Not assigned		
R 70	Not assigned		
R 71	Var,MF,(RJ-6P 20KΩ)	20kΩ,1/2W	
R 72	Not assigned		
R 73	Var,MF,(RJ-6P 20KΩ)	20kΩ,1/2W	
R 74	Var,MF,(RJ-6P 20KΩ)	20kΩ,1/2W	
R 75	Var,MF,(RJ-6P 20KΩ)	20kΩ,1/2W	
R 76	Not assigned		
R 77	Var MF,(RJ-6P *)	100Ω to 2MΩ,1/2W	*5kΩ
R 78	Var,MF,(RJ-6P 500Ω)	500Ω,1/2W	
R 79	Var,MF,(RJ-6P 2KΩ)	2kΩ,1/2W	
R 80	Var,MF,(RJ-6P 10KΩ)	10kΩ,1/2W	
R 81	Var,MF,(RJ-6P 20KΩ)	20kΩ,1/2W	
R 82	Var,MF,(RJ-6P 20KΩ)	20kΩ,1/2W	
R 83	CM,(RM73B2B392JD)	3.9kΩ,±5%,1/8W	

( ): Manufacturer's part number
• : Selected at factory

Parts List: AMP (A1, MH952A)

2

CKT REF	DESCRIPTION	RATING	NOTE
C 1	Elect,(SR25VB-220)	220μF,±20%,25V	
C 2	Elect,(SR25VB-220)	220μF,±20%,25V	
C 3	Elect,(SR25VB-220)	220μF,±20%,25V	
C 4	Elect,(SR25VB-220)	220μF,±20%,25V	
C 5	Elect,(SR10VB-220)	220μF,±20%,10V	
C 6	Elect,(SR10VB-220)	220μF,±20%,10V	
C 7	Tant,(CS734E1C226M)	22μF,±20%,16V	
C 8	Tant,(CS734E1C226M)	22μF,±20%,16V	
C 9	Not assigned		
C 10	Not assigned		
C 11	Tant,(CS734E1C226M)	22μF,±20%,16V	
C 12	Tant,(CS734E1C226M)	22μF,±20%,16V	
C 13	Tant,(CS734E1C226M)	22μF,±20%,16V	
C 14	Tant,(CS734E1C226M)	22μF,±20%,16V	
C 15	Tant,(CS734E1C226M)	22μF,±20%,16V	
C 16	[illegible]	22μF,±20%,16V	
C 17	Tant,(CS734E1D156M)	15μF,±20%,20V	
C 18	Elect,(SR16VB-22)	22μF,±20%,16V	
C 19	Elect,(SR16VB-22)	22μF,±20%,16V	
C 20	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V	
C 21	Cer,(CK737F1H105Z)	[illegible]	
C 22	Cer,(CK732B1H103K)	0.01μF,±10%,50V	
C 23	Cer,(CK732B1H103K)	0.01μF,±10%,50V	
C 24	Not assigned		
C 25	Not assigned		
C 26	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V	
C 27	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V	
C 28	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V	
C 29	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V	
C 30	Not assigned		
C 31	Not assigned		
C 32 to C 37	Cer,(CK732B1H103K)	0.01μF,±10%,50V	
C 38	Not assigned		
C 39	Not assigned		
C 40	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V	
C 41	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V	
C 42	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V	
C 43	Not assigned		
C 44	Not assigned		
C 45 to C 53	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V	
C 54	Elect,(SR25VB-220)	220μF,±20%,25V	
C 55	Elect,(SR25VB-220)	220μF,±20%,25V	
C 56 to C 72	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V	

( ): Manufacturer's part number
• : Selected at factory

Parts List: AMP (A1, MH952A)

CKT REF	DESCRIPTION	RATING	NOTE
C 73	Elect,(SR25VB-100)	100μF,±20%,25V	
C 74	Elect,(SR25VB-100)	100μF,±20%,25V	
C 75	Elect,(SR25VB-100)	100μF,±20%,25V	
C 76	Elect,(SR25VB-100)	100μF,±20%,25V	
C 77	Elect,(SR25VB-100)	100μF,±20%,25V	
C 78	Elect,(SR25VB-100)	100μF,±20%,25V	
C 79	Cer,(CC732CH1H101J(A2))	100pF,±5%,50V	
C 80	Cer,(CC732CH1H101J(A2))	100pF,±5%,50V	
C 81	Cer,(CC733CH1H102J(A3))	1000pF,±5%,50V	
C 82	Not assigned		
C 83	Cer,(CC732CH1H680J(W1))	68pF,±5%,50V	
C 84	Cer,(CC732CH1H * J)	12 to 330pF,±5%,50V	Q'ty 0 or 1,*Opened
C 85	Cer,(CC732CH1H * J)	12 to 330pF,±5%,50V	Q'ty 0 or 1,*Opened
C 86	Not assigned		
C 87	Not assigned		
C 88	Not assigned		
C 89	Not assigned		
C 90	Not assigned		
C 91	Cer,(CC924CH1H102J)	1000pF,±5%,50V	
C 92	Not assigned		
C 93	Not assigned		
C 94 to C101	Tant,(CSE V6R8M)	6.8μF,±20%,35V	
J 1	Not assigned		
J 2	Plug, (HIF3FB-30PA-2.54DSA)	30pins	
J 3	Not assigned		
J 4	Jack,(27DP-LR-PC)		
J 5	Not assigned		
J 6	Not assigned		
J 7	Plug,(FFC-2AMEP)	2pins	
J 8	Jack,(DIC-130)		
J 9	Jack,(HRM300-126S)		
K 1	Not assigned		
K 2	Not assigned		
L 1	Coil,(SN-5-400)	48μH,2A	
L 2	Coil,(SN-5-400)	48μH,2A	
L 3	Coil,(SN-5-400)	48μH,2A	
L 4	Not assigned		
L 5	Not assigned		

( ): Manufacturer's part number
• : Selected at factory

Parts List: AMP (A1, MH952A)

CKT REF	DESCRIPTION	RATING	NOTE
Q 1	IC,(CLC103AI)		
Q 2	Not assigned		
Q 3	IC,(CLC103AI)		
Q 4	IC,(CLC103AI)		
Q 5	IC,(CLC103AI)		
Q 6	IC,(LF356BN)		
Q 7	IC,(LF356BN)		
Q 8	IC,(LF356BN)		
Q 9	Not assigned		
Q 10	IC,(μPC624C)		
Q 11	IC,(μPC154C)		
Q 12	Di,breakdown,(1N821)	6.2V,±5%,400mW	
Q 13	Di,breakdown,(1N821)	6.2V,±5%,400mW	
Q 14	Not assigned		
Q 15	Not assigned		
Q 16	Di,breakdown,(1N821)	6.2V,±5%,400mW	
Q 17	Di,breakdown,(1N821)	6.2V,±5%,400mW	
Q 18	Di,breakdown,(1N821)	6.2V,±5%,400mW	
Q 19	Di,breakdown,(1N821)	6.2V,±5%,400mW	
Q 20	Di,breakdown,(1N821)	6.2V,±5%,400mW	
Q 21	Di,breakdown,(1N821)	6.2V,±5%,400mW	
Q 22	Not assigned		
Q 23	Not assigned		
Q 24	Di,(1SS99)		
Q 25	Di,(1SS99)		
Q 26	Di,(1SS99)		
Q 27	Di,(1SS99)		
Q 28	Di,(1SS99)		
Q 29	Di,(1SS99)		
Q 30	Not assigned		
Q 31	Not assigned		
Q 32	Not assigned		
Q 33	Not assigned		
Q 34	Di,(1SS99)		
Q 35	Di,(1SS99)		
Q 36	Not assigned		
Q 37	Not assigned		
Q 38	Not assigned		
Q 39	IC,(HI1-201HS-5)		
Q 40	Not assigned		
Q 41	Not assigned		
Q 42	IC,(74LS123)		
Q 43	IC,(74LS14)		
Q 44	Not assigned		
Q 45	Not assigned		

( ): Manufacturer's part number
• : Selected at factory

Parts List: AMP (A1, MH952A)

CKT REF	DESCRIPTION	RATING		NOTE
R 46	Not assigned			
R 47	Not assigned			
R 1	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 2	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 3	Not assigned			
R 4	Not assigned			
R 5	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 6	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 7	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 8	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 9	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 10	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 11	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 12	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 13	Not assigned			
R 14	Not assigned			
R 15	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 16	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 17	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 18	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 19	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 20	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 21	CM,(RM73B2B223JD)	22kΩ,±5%,1/8W		
R 22	Not assigned			
R 23	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 24	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 25	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 26	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 27	CM,(RM73B2B750JD)	75Ω,±5%,1/8W		
R 28	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 29	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 30	Not assigned			
R 31	Not assigned			
R 32	Not assigned			
R 33	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 34	CM,(RM73B2B104JD)	100kΩ,±5%,1/8W		
R 35	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 36	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 37	Not assigned			
R 38	Not assigned			
R 39	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 40	CM,(RM73B2B272JD)	2.7kΩ,±5%,1/8W		
R 41	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 42	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		

( ): Manufacturer's part number
* : Selected at factory

Parts List: AMP (A1, MH952A)

CKT REF	DESCRIPTION	RATING		NOTE
R 43	CM,(RM73B2B222JD)	2.2kΩ,±5%,1/8W		
R 44	CM,(RM73B2B222JD)	2.2kΩ,±5%,1/8W		
R 45	CM,(RM73B2B152JD)	1.5kΩ,±5%,1/8W		
R 46	CM,(RM73B2B750JD)	75Ω,±5%,1/8W		
R 47	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 48	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 49	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 50	CM,(RM73B2B750JD)	75Ω,±5%,1/8W		
R 51	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 52	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 53	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 54	CM,(RM73B2B750JD)	75Ω,±5%,1/8W		
R 55	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 56	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 57	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 58	CM,(RM73B2B152JD)	1.5kΩ,±5%,1/8W		
R 59	Not assigned			
R 60	Not assigned			
R 61	Not assigned			
R 62	CF,(ARD25T153J)	15kΩ,±5%,1/4W		
R 63	Var,MF,(RJ-6P 100Ω)	100Ω,1/2W		
R 64	Not assigned			
R 65	Var,MF,(RJ-6P 100Ω)	100Ω,1/2W		
R 66	Var,MF,(RJ-6P 500Ω)	500Ω,1/2W		
R 67	Var,MF,(RJ-6P 500Ω)	500Ω,1/2W		
R 68	Not assigned			
R 69	Not assigned			
R 70	Not assigned			
R 71	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 72	Not assigned			
R 73	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 74	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 75	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 76	Not assigned			
R 77	Not assigned			
R 78	Var,MF,(RJ-6P 500Ω)	500Ω,1/2W		
R 79	Var,MF,(RJ-6P 2kΩ)	2kΩ,1/2W		
R 80	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 81	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 82	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 83	CM,(RM73B2B392JD)	3.9kΩ,±5%,1/8W		

( ): Manufacturer's part number
* : Selected at factory

Parts List: AMP(A1, MH958A/MH968A) 2

CKT REF	DESCRIPTION	RATING		NOTE
C 1	Elect,(SR25VB-220)	220μF,±20%,25V		
C 2	Elect,(SR25VB-220)	220μF,±20%,25V		
C 3	Elect,(SR25VB-220)	220μF,±20%,25V		
C 4	Elect,(SR25VB-220)	220μF,±20%,25V		
C 5	Elect,(SR10VB-220)	220μF,±20%,10V		
C 6	Elect,(SR10VB-220)	220μF,±20%,10V		
C 7	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 8	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 9	Not assigned			
C 10	Not assigned			
C 11	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 12	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 13	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 14	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 15	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 16	Tant,(CS734E1C226M)	22μF,±20%,16V		
C 17	Tant,(CS734E1D156M)	15μF,±20%,20V		
C 18	Elect,(SR16VB-22)	22μF,±20%,16V		
C 19	Elect,(SR16VB-22)	22μF,±20%,16V		
C 20	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 21	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 22	Cer,(CK732B1H102K)	1000pF,±10%,50V		
C 23	Cer,(CK732B1H102K)	1000pF,±10%,50V		
C 24	Not assigned			
C 25	Not assigned			
C 26	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 27	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 28	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 29	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 30	Not assigned			
C 31	Not assigned			
C 32	Cer,(CK732B1H102K)	1000pF,±10%,50V		
C 33	Cer,(CK732B1H102K)	1000pF,±10%,50V		
C 34	Cer,(CK732B1H102K)	1000pF,±10%,50V		
C 35	Cer,(CK732B1H102K)	1000pF,±10%,50V		
C 36	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 37	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 38	Not assigned			
C 39	Not assigned			
C 40	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 41	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 42	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 43	Not assigned			
C 44	Not assigned			
C 45	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 46	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 47	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		

( ): Manufacturer's part number
* : Selected at factory

Parts List: AMP(A1, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
C 48	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 49	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 50	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 51	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 52	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 53	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 54	Elect,(SR25VB-220)	220μF,±20%,25V		
C 55	Elect,(SR25VB-220)	220μF,±20%,25V		
C 56 to C 72	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 73	Elect,(SR25VB-100)	100μF,±20%,25V		
C 74	Elect,(SR25VB-100)	100μF,±20%,25V		
C 75	Elect,(SR25VB-100)	100μF,±20%,25V		
C 76	Elect,(SR25VB-100)	100μF,±20%,25V		
C 77	Elect,(SR25VB-100)	100μF,±20%,25V		
C 78	Elect,(SR25VB-100)	100μF,±20%,25V		
C 79	Cer,(CC732CH1H101J(A2))	100pF,±5%,50V		
C 80	Cer,(CC732CH1H101J(A2))	100pF,±5%,50V		
C 81	Cer,(CC733CH1H102J(A3))	1000pF,±5%,50V		
C 82	Not assigned			
C 83	Cer,(CC732CH1H680J(W1))	68pF,±5%,50V		
C 84 to C 90	Not assigned			
C 91	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 92	Not assigned			
C 93	Not assigned			
C 94	Cer,(CK732B1H102K(A3))	1000pF,±10%,50V		
C 95 to C102	Tant,(CS734E1V685M)	6.8μF,±20%,35V		
C103	Cer,(CC45CH1H000-101JY)	0 to 100pF,±5%,50V		*10pF
J 1	Not assigned			
J 2	Plug, (HIF3FB-30PA-2.54DSA)	30pins		
J 3	Not assigned			
J 4	Jack,(27DP-LR-PC)			
J 5	Not assigned			
J 6	Not assigned			
J 7	Plug,(FFC-2AMEP)	2pins		
J 8	Jack,(DIC-130)			
J 9	Jack,(HRMJ00-126S)			
K 1	Not assigned			
K 2	Not assigned			

( ): Manufacturer's part number
* : Selected at factory

M-1

Parts List: AMP(A1, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
L 1	Coil,(SN-5-400)	48μH,2A		
L 2	Coil,(SN-5-400)	48μH,2A		
L 3	Coil,(SN-5-400)	48μH,2A		
L 4	Not assigned			
L 5	Not assigned			
Q 1	IC,(CLC103AI)			
Q 2	Not assigned			
Q 3	IC,(CLC103AI)			
Q 4	IC,(CLC103AI)			
Q 5	IC,(CLC103AI)			
Q 6	IC,(LF356BN)			
Q 7	IC,(LF356BN)			
Q 8	IC,(LF356BN)			
Q 9	Not assigned			
Q 10	IC,(μPC624C)			
Q 11	IC,(μPC154C)			
Q 12	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 13	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 14	Not assigned			
Q 15	Not assigned			
Q 16	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 17	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 18	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 19	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 20	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 21	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 22	Not assigned			
Q 23	Not assigned			
Q 24	Not assigned			
Q 25	Di,(1SS99)			
Q 26	Not assigned			
Q 27	Not assigned			
Q 28	Not assigned			
Q 29	Not assigned			
Q 30	Not assigned			
Q 31	Not assigned			
Q 32	Not assigned			
Q 33	Not assigned			
Q 34	Not assigned			
Q 35	Not assigned			
Q 36	Not assigned			
Q 37	Not assigned			
Q 38	Not assigned			
Q 39	IC,(MI1-201HS-5)			
Q 40	Not assigned			

( ): Manufacturer's part number
* : Selected at factory

Parts List: AMP(A1, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
Q 41	Not assigned			
Q 42	IC,(74LS123)			
Q 43	IC,(74LS14)			
Q 44	Not assigned			
Q 45	Not assigned			
Q 46	Not assigned			
Q 47	Not assigned			
Q 48				
to	Di,(1SS99)			
Q 51				
Q 56				
to	Di,(1SS99)			
Q 59				
R 1	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 2	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 3	Not assigned			
R 4	Not assigned			
R 5	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 6	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 7	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 8	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 9	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 10	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 11	CM,(RM73B2B102J)	1kΩ,±5%,1/8W		
R 12	CM,(RM73B2B102J)	1kΩ,±5%,1/8W		
R 13	Not assigned			
R 14	Not assigned			
R 15	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 16	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 17	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 18	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 19	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 20	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 21	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 22	Not assigned			
R 23	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 24	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 25	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 26	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 27	CM,(RM73B2B750JD)	75Ω,±5%,1/8W		
R 28	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 29	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 30	Not assigned			

( ): Manufacturer's part number
* : Selected at factory

Parts List: AMP(A1, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
R 31	Not assigned			
R 32	Not assigned			
R 33	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 34	CM,(RM73B2B104JD)	100kΩ,±5%,1/8W		
R 35	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 36	CM,(RM73B2B103JD)	10kΩ,±5%,1/8W		
R 37	Not assigned			
R 38	Not assigned			
R 39	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 40	CM,(RM73B2B272JD)	2.7kΩ,±5%,1/8W		
R 41	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 42	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 43	CM,(RM73B2B222JD)	2.2kΩ,±5%,1/8W		
R 44	CM,(RM73B2B222JD)	2.2kΩ,±5%,1/8W		
R 45	CM,(RM73B2B152JD)	1.5kΩ,±5%,1/8W		
R 46	CM,(RM73B2B750JD)	75Ω,±5%,1/8W		
R 47	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 48	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 49	Not assigned			
R 50	Not assigned			
R 51	Not assigned			
R 52	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 53	Not assigned			
R 54	Not assigned			
R 55	Not assigned			
R 56	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 57	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 58	CM,(RM73B2B152JD)	1.5kΩ,±5%,1/8W		
R 59	Not assigned			
R 60	Not assigned			
R 61	Not assigned			
R 62	CM,(RM73B2B153JD)	15kΩ,±5%,1/8W		
R 63	Not assigned			
R 64	Not assigned			
R 65	Not assigned			
R 66	Not assigned			
R 67	Not assigned			
R 68	Not assigned			
R 69	Not assigned			
R 70	Not assigned			
R 71	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 72	Not assigned			
R 73	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 74	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 75	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		

( ): Manufacturer's part number
* : Selected at factory

Parts List: AMP(A1, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
R 76	Not assigned			
R 77	Not assigned			
R 78	Var,MF,(RJ-6P 500Ω)	500Ω,1/2W		
R 79	Var,MF,(RJ-6P 2kΩ)	2.0kΩ,1/2W		
R 80	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 81	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 82	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 83	CM,(RM73B2B392JD)	3.9kΩ,±5%,1/8W		
R 84	CM,(RM73B2B301JD)	300Ω,±5%,1/8W		
R 85	Not assigned			
R 86	CM,(RM73B2B223JD)	22kΩ,±5%,1/8W		
R 87	CM,(RM73B2B223JD)	22kΩ,±5%,1/8W		
R 88	Not assigned			
R 89	Not assigned			
R 90	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 91	Not assigned			
R 92	CM,(RM73B2B222JD)	2.2kΩ,±5%,1/8W		
R 93	CM,(RM73B2B392JD)	3.9kΩ,±5%,1/8W		

( ): Manufacturer's part number
* : Selected at factory

Parts List: RECEIVER (A2, MH951A) 3

CKT REF	DESCRIPTION	RATING		NOTE
A 1	I/V CONV. PC board			W4W8640
A 2	APD module			

( ): Manufacturer's part number
* : Selected at factory

Parts List: RECEIVER (A2, MH952A) 3

CKT REF	DESCRIPTION	RATING		NOTE
A 1	I/V CONV. PC board			W4W8644
A 2	APD module			

( ): Manufacturer's part number
* : Selected at factory

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Parts List: RECEIVER (A2, MH958A/MH968A) 3

CKT REF	DESCRIPTION	RATING		NOTE
A 1	I/V CONV. PC board			W4W13074
A 2	APD module			

( ): Manufacturer's part number
* : Selected at factory

W4W13072 | 1/1

Parts List: I/V CONV. (A2-A1, MH951A) 4

CKT REF	DESCRIPTION	RATING		NOTE
C 1	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 2	Cer,(CK732B1H103K(A4))	0.01μF,±10%,50V		
C 3	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 4	Cer,(CK733F1H104Z(A5))	0.01μF,+80/-20%,50V		
C 5	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 6	Elect,(SRA16VB22)	22μF,±20%,16V		
C 7	Elect,(SRA16VB22)	22μF,±20%,16V		
C 8	Elect,(SR25VB-220)	220μF,±20%,25V		
C 9	Elect,(SR25VB-220)	220μF,±20%,25V		
C 10	Elect,(SR25VB-220)	220μF,±20%,25V		
C 11	Elect,(SR25VB-220)	220μF,±20%,25V		
C 12	Elect,(SM350T3R3)	3.3μF,±20%,350V		
C 13	Elect,(SM350T3R3)	3.3μF,±20%,350V		
C 14	Elect,(SM350T3R3)	3.3μF,±20%,350V		
C 15	Not assigned			
C 16	Not assigned			
J 1	Plug,(DF1-8P2.5DSA)	8pins		
J 2	Jack,(HRM300-126S)			
L 1	Coil,(LF8-101K)	100μH		
L 2	Coil,(LF8-101K)	100μH		
L 3	Coil,(LF8-101K)	100μH		
Q 1	IC,(CLC300A)			
Q 2	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 3	Di,breakdown,(1N821)	6.2V,±5%,400mW		
R 1	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 2	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 3	CM,(RM73B2B561JD)	560kΩ,±5%,1/8W		
R 4	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 5	Var,MF,(RJ-6P 20KΩ)	20kΩ,1/2W		
R 6	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W		
R 7	Not assigned			
R 8	Not assigned			
R 9	Var,MF,(RJ-6P 2KΩ)	2.0kΩ,1/2W		

( ): Manufacturer's part number
* : Selected at factory

W4W8640 | 1/1

Parts List. I/V CONV. (A2-A1, MH952A) 4

CKT REF	DESCRIPTION	RATING		NOTE
C 1	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 2	Cer,(CK732B1H103K(A4))	0.01μF,±10%,50V		
C 3	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 4	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 5	Cer,(CK732B1H103K)	0.01μF,±10%,50V		
C 6	Elect,(SRA16VB22)	22μF,±10%,16V		
C 7	Elect,(SRA16VB22)	22μF,±20%,16V		
C 8	Elect,(SR25VB-220)	220μF,±20%,25V		
C 9	Elect,(SR25VB-220)	220μF,±20%,25V		
C 10	Elect,(SR25VB-220)	220μF,±20%,25V		
C 11	Elect,(SR25VB-220)	220μF,±20%,25V		
C 12	Elect,(SM50T100(M))	100μF,±20%,50V		
C 13	Elect,(SM50T100(M))	100μF,±20%,50V		
C 14	Elect,(SM50T100(M))	100μF,±20%,50V		
C 15	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 16	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 17	Tant,(CS E1V0R1M)	0.1μF,±20%,35V		
C 18	Tant,(CS E1V0R1M)	0.1μF,±20%,35V		
J 1	Plug,(DF1-8P2.5DSA)	8pins		
J 2	Jack,(HRM300-126S)			
L 1	Coil,(LF8-101K)	100μH		
L 2	Coil,(LF8-101K)	100μH		
L 3	Coil,(LF8-101K)	100μH		
Q 1	IC,(CLC300A)			
Q 2	Di,breakdown,(1N821)	6.2V,±5%,400mW		
Q 3	Di,breakdown,(1N821)	6.2V,±5%,400mW		
R 1	CM,(RM73B2B470JD)	47Ω,±5%,1/8W		
R 2	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 3	CM,(RM73B2B561JD)	560kΩ,±5%,1/8W		
R 4	CM,(RM73B2B102JD)	1.00kΩ,±5%,1/8W		
R 5	Var,MF,(RJ-6P 20KΩ)	20kΩ,1/2W		
R 6	CM,(RM73B2B102JD)	1.00kΩ,±5%,1/8W		
R 7	Not assigned			
R 8	Not assigned			
R 9	Var,MF,(RJ-6P 2KΩ)	2.0kΩ,1/2W		

( ): Manufacturer's part number
* : Selected at factory

W4W8644 | 1/1

Part List: I/V CONV.(A2-A1, MH958A/MH968A)

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CKT REF	DESCRIPTION	RATING	NOTE
C 1	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V	
C 2	Cer,(CK732B1H103K(A4))	0.001μF,±10%,50V	
C 3	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V	
C 4	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C 5	Cer,(CK732B1H102K)	1000pF,±10%,50V	
C 6	Elect,(SRA16VB22)	22μF,±10%,16V	
C 7	Elect,(SRA16VB22)	22μF,±20%,16V	
C 8	Elect,(SR25VB-220)	220μF,±20%,25V	
C 9	Elect,(SR25VB-220)	220μF,±20%,25V	
C 10	Elect,(SR25VB-220)	220μF,±20%,25V	
C 11	Elect,(SR25VB-220)	220μF,±20%,25V	
C 12	Elect,(SM350T3R3)	3.3μF,±20%,350V	
C 13	Elect,(SM350T3R3)	3.3μF,±20%,350V	
C 14	Elect,(SM350T3R3)	3.3μF,±20%,350V	
C 15	Not assigned		
C 16	Not assigned		
C 17	Tant,(CS-E1V0R1M)	0.1μF,±20%,35V	
C 18	Tant,(CS-E1V0R1M)	0.1μF,±20%,35V	
C 19	Not assigned		
C 20	Plast,(CF922N2E104K)	0.1μF,±10%,250V	
J 1	Plug,(DF1-8P2.5DSA)	8pins	
J 2	Jack,(HRM300-126S)		
L 1	Coil,(LP8-101K)	100μH	
L 2	Coil,(LP8-101K)	100μH	
L 3	Not assigned		
Q 1	IC,(CLC300A)		
Q 2	Di,breakdown,(1N821)	6.2V,±5%,400mW	
Q 3	Di,breakdown,(1N821)	6.2V,±5%,400mW	
R 1	CM,(RM73B2B470JD)	47Ω,±5%,1/8W	
R 2	Not assigned		
R 3	CM,(RM73B2B561JD)	560Ω,±5%,1/8W	
R 4	CM,(RM73B2B102JD)	1.00kΩ, 5%,1/8W	
R 5	Var,MF,(RJ-6P 20KΩ)	20kΩ,1/2W	
R 6	CM,(RM73B2B102JD)	1.00kΩ,±5%,1/8W	
R 7	Not assigned		
R 8	Not assigned		
R 9	CF,(ARD25T152J)	1.5kΩ,±5%,1/4W	
R 10	CF,(RS2FS223JL)	22kΩ,±5%,2W	
R 11	CF,(ARD25T000-470J)	0 to 470Ω,±5%,1/4W	*100

( ): Manufacturer's part number
* : Selected at factory

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Parts List: LD DRIVER2 (A3, MH951A/MH952A)

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CKT REF	DESCRIPTION	RATING	NOTE
C .	Cer,(CK732B1H103K(A4))	0.01μF,±20%,50V	
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C .	Cer,(CK732B1H102K(A3))	1000pF,±20%,50V	
C .	Not assigned		
C .	Not assigned		
C .	Not assigned		
C .	Not assigned		
C .	Not assigned		
C .	Not assigned		
C .	Tant,(CS7J4E1D156M)	15μF,±20%,20V	
C .	Not assigned		
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C .	Elect,(SR10VB-47)	47μF,±20%,10V	
C .	Elect,(SR10VB-47)	47μF,±20%,10V	
C .	Elect,(SR10VB-47)	47μF,±20%,10V	
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
C .	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V	
C .	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V	
C .	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V	
C .	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V	
C .	Elect,(SR25VB-10)	10μF,±20%,25V	
C .	Not assigned		
C .	Not assigned		
C .	Cer,(CC732CH1H220J(J1))	22pF,±5%,50V	
C .	Cer,(CC732CH1H101J(A2))	100pF,±5%,50V	
C .	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V	
. .	Plug,(DF1-10P2.5DSA)	10pins	
. .	Jack,(27DP-LR-PC)		
. .	Plug,(DF1-2P2.5DSA)	2pins	
. .	Jack,(27DP-LR-PC)		
. .	Not assigned		
L .	Delay line, (DE6B-500T10-D3)		
L .	Delay line, (DE6B-500T10-D3)		

( ): Manufacturer's part number
* : Selected at factory

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Parts List: LD DRIVER2 (A3, MH951A/MH952A)

CKT REF	DESCRIPTION	RATING	NOTE
L 3	Not assigned		
L 4	Delay line, (DE6B-500TA0-D3)		
L 5	Not assigned		
L 6	Delay line,(JD3100C)		
Q 1	Not assigned		
Q 2	Not assigned		
Q 3	Tr,(2SC2954)		
Q 4	Not assigned		
Q 5	Tr,(2SC3585(R42))		
Q 6	Tr,(2SC3585(R42))		
Q 7	Tr,(2SC3585(R42))		
Q 8	Tr,(2SC3585(R42))		
Q 9	IC,(μPB661B)		
Q 10	IC,(μPB602B)		
Q 11	Tr,(2SC1623(L5 OR L6))		
Q 12	Not assigned		
Q 13	Photo coupler,(PS2007B)		
Q 14	IC,(HD74LS221P)		
Q 15	Tr,(2SC1623(L5 OR L6))		
Q 16	Not assigned		
Q 17	Not assigned		
Q 18	Not assigned		
Q 19	Not assigned		
R 1	Not assigned		
R 2	Not assigned		
R 3	Not assigned		
R 4	Not assigned		
R 5	Not assigned		
R 6	CM,(RM73B2B100JD)	10Ω,±5%,1/8W	
R 7	CM,(RM73B2B123JD)	12kΩ,±5%,1/8W	
R 8	CM,(RM73B2B182JD)	1.8kΩ,±5%,1/8W	
R 9	CM,(RM73B2B151JD)	150Ω,±5%,1/8W	
R 10	CM,(RM73B2B151JD)	150Ω,±5%,1/8W	
R 11	CM,(RM73B2B101JD)	100Ω,±5%,1/8W	
R 12	CM,(RM73B2B101JD)	100Ω,±5%,1/8W	
R 13	CM,(RM73B2B331JD)	330Ω,±5%,1/8W	
R 14	CM,(RM73B2B561JD)	560Ω,±5%,1/8W	
R 15	CM,(RM73B2B151JD)	150Ω,±5%,1/8W	
R 16	CM,(RM73B2B560JD)	56Ω,±5%,1/8W	
R 17	CM,(RM73B2B560JD)	56Ω,±5%,1/8W	
R 18	CM,(RM73B2B821JD)	820Ω,±5%,1/8W	
R 19	CM,(RM73B2B101JD)	100Ω,±5%,1/8W	
R 20	CM,(RM73B2B101JD)	100Ω,±5%,1/8W	

( ): Manufacturer's part number
* : Selected at factory

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Parts List: LD DRIVER2 (A3, MH951A/MH952A)

CKT REF	DESCRIPTION	RATING	NOTE
R 21	CM,(RM73B2B151JD)	150Ω,±5%,1/8W	
R 22	CM,(RM73B2B151JD)	150Ω,±5%,1/8W	
R 23	Not assigned		
R 24	Not assigned		
R 25	Not assigned		
R 26	CM,(RM73B2B151JD)	150Ω,±5%,1/8W	
R 27	CM,(RM73B2B151JD)	150Ω,±5%,1/8W	
R 28	CM,(RM73B2B560JD)	56Ω,±5%,1/8W	
R 29	CM,(RM73B2B101JD)	100Ω,±5%,1/8W	
R 30	CM,(RM73B2B151JD)	150Ω,±5%,1/8W	
R 31	CM,(RM73B2B221JD)	220Ω,±5%,1/8W	
R 32	CM,(RM73B2B221JD)	220Ω,±5%,1/8W	
R 33	CM,(RM73B2B510JD)	51Ω,±5%,1/8W	
R 34	CM,(RM73B2B122JD)	1.2kΩ,±5%,1/8W	
R 35	Var,MF,(RJ-6P 2KΩ)	2kΩ,1/2W	
R 36	Not assigned		
R 37	Not assigned		
R 38	Not assigned		
R 39	Not assigned		
R 40	Not assigned		
R 41	Not assigned		
R 42	Not assigned		
R 43	Not assigned		
R 44	CM,(RM73B2B220JD)	22Ω,±5%,1/8W	
R 45	CM,(RM73B2B391JD)	390Ω,±5%,1/8W	
R 46	CM,(RM73B2B391JD)	390Ω,±5%,1/8W	
R 47	CM,(RM73B2B152JD)	1.5kΩ,±5%,1/8W	
R 48	CM,(RM73B2B472JD)	4.7kΩ,±5%,1/8W	
R 49	CM,(RM73B2B102JD)	1kΩ,±5%,1/8W	
R 50	CM,(RM73B2B272JD)	2.7kΩ,±5%,1/8W	
R 51	CM,(RM73B2B152JD)	1.5kΩ,±5%,1/8W	
R 52	Var,MF,(RJ-6P 5KΩ)	5kΩ,1/2W	

( ): Manufacturer's part number
* : Selected at factory

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Parts List: LD DRIVER2 (A3, MH958A/MH968A) 5

CKT REF	DESCRIPTION	RATING		NOTE
C 1	Cer,(CK732B1H103K(A4))	0.01μF,±10%,50V		
C 2	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 3	Cer,(CK732B1H102K(A3))	1000pF,±10%,50V		
C 4	Not assigned			
C 5	Not assigned			
C 6	Not assigned			
C 7	Not assigned			
C 8	Not assigned			
C 9	Not assigned			
C 10	Tant,(CS734E1D156M)	15μF,±20%,20V		
C 11	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 12	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 13	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 14	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 15	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 16	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 17	Elect,(SR10VB-47)	47μF,±20%,10V		
C 18	Elect,(SR10VB-47)	47μF,±20%,10V		
C 19	Elect,(SR10VB-47)	47μF,±20%,10V		
C 20	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 21	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 22	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 23	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
C 24	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V		
C 25	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V		
C 26	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V		
C 27	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V		
C 28	Elect,(SR16VB-220)	220μF,±20%,16V		
C 29	Not assigned			
C 30	Not assigned			
C 31	Cer,(CC732CH1H220J(J1))	22pF,±5%,50V		
C 32	Cer,(CC732CH1H101J(A2))	100pF,±5%,50V		
C 33	Cer,(CK733F1H104Z(A5))	0.1μF,+80/-20%,50V		
J 1	Plug,(DF1-10P2.5DSA)	10pins		
J 2	Jack,(27DP-LR-PC)			
J 3	Plug,(DF1-2P2.5DSA)	2pins		
J 4	Jack,(27DP-LR-PC)			
L 1	Delay line, (DE4A-500T10-D2)			
L 2	Delay line, (DE4A-500T10-D2)			
L 3	Not assigned			
L 4	Delay line, (DE6B-500TA0-D3)			

( ): Manufacturer's part number
* : Selected at factory

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Parts List: LD DRIVER2 (A3, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
L 5	Not assigned			
L 6	Delay line,(JD3100C)			
Q 1	Not assigned			
Q 2	Not assigned			
Q 3	Tr,(2SC2954)			
Q 4	Not assigned			
Q 5	Tr,(2SC3585(R42))			
Q 6	Tr,(2SC3585(R42))			
Q 7	Tr,(2SC3585(R42))			
Q 8	Tr,(2SC3585(R42))			
Q 9	IC,(μPB661B)			
Q 10	IC,(μPB602B)			
Q 11	IC,(TC4028BF)			
Q 12	IC,(μPA67C)			
Q 13	Photo coupler,(PS2007B)			
Q 14	IC,(HD74LS221P)			
Q 15	Tr,(2SC1623(L5 OR L6))			
R 1	Not assigned			
R 2	Not assigned			
R 3	Not assigned			
R 4	Not assigned			
R 5	Not assigned			
R 6	CM,(RM73B2B100JD)	10Ω,±5%,1/8W		
R 7	CM,(RM73B2B123JD)	12kΩ,±5%,1/8W		
R 8	CM,(RM73B2B182JD)	1.8kΩ,±5%,1/8W		
R 9	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 10	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 11	CM,(RM73B2B101JD)	100Ω,±5%,1/8W		
R 12	CM,(RM73B2B101JD)	100Ω,±5%,1/8W		
R 13	Not assigned			
R 14	Not assigned			
R 15	Not assigned			
R 16	CM,(RM73B2B560JD)	56Ω,±5%,1/8W		
R 17	CM,(RM73B2B560JD)	56Ω,±5%,1/8W		
R 18	CM,(RM73B2B821JD)	820Ω,±5%,1/8W		
R 19	CM,(RM73B2B101JD)	100Ω,±5%,1/8W		
R 20	CM,(RM73B2B101JD)	100Ω,±5%,1/8W		
R 21	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 22	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 23	Not assigned			
R 24	Not assigned			
R 25	Not assigned			

( ): Manufacturer's part number
* : Selected at factory

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Parts List: LD DRIVER2 (A3, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
R 26	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 27	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 28	CM,(RM73B2B560JD)	56Ω,±5%,1/8W		
R 29	CM,(RM73B2B101JD)	100Ω,±5%,1/8W		
R 30	CM,(RM73B2B151JD)	150Ω,±5%,1/8W		
R 31	CM,(RM73B2B221JD)	220Ω,±5%,1/8W		
R 32	CM,(RM73B2B221JD)	220Ω,±5%,1/8W		
R 33	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 34	CM,(RM73B2B122JD)	1.2kΩ,±5%,1/8W		
R 35	CM,(RM73B2B122JD)	1.2kΩ,±5%,1/8W		
R 36	MF,(RN14K2E4220D)	357Ω,±0.5%,1/4W		
R 37	MF,(RN14K2E8660D)	866Ω,±0.5%,1/4W		
R 38	MF,(RN14K2E1131D)	1.13kΩ,±0.5%,1/4W		
R 39	MF,(RN14K2E1691D)	1.69kΩ,±0.5%,1/4W		
R 40	Not assigned			
R 41	Not assigned			
R 42	Not assigned			
R 43	Not assigned			
R 44	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 45	CM,(RM73B2B391JD)	390Ω,±5%,1/8W		
R 46	CM,(RM73B2B391JD)	390Ω,±5%,1/8W		
R 47	CM,(RM73B2B152JD)	1.5kΩ,±5%,1/8W		
R 48	CM,(RM73B2B472JD)	4.7kΩ,±5%,1/8W		
R 49	CM,(RM73B2B102JD)	1.0kΩ,±5%,1/8W		
R 50	CM,(RM73B2B272JD)	2.7kΩ,±5%,1/8W		
R 51	CM,(RM73B2B152JD)	1.5kΩ,±5%,1/8W		
R 52	Var,MF,(RJ-6P 5kΩ)	5kΩ,1/2W		

( ): Manufacturer's part number
* : Selected at factory

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Parts List: CONT & APD (A5, MH951A) 6

CKT REF	DESCRIPTION	RATING		NOTE
C 1	Elect,(SRE10VB-10)	10μF,±20%,10V		
C 2	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 3	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 4	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V		
C 5	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V		
C 6	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V		
C 7	Elect,(SR16VB-1000)	1000μF,±20%,16V		
C 8	Elect,(SR16VB-1000)	1000μF,±20%,16V		
C 9	Elect,(SR25VB-47)	47μF,±20%,25V		
C 10	Elect,(SR10VB-47)	47μF,±20%,10V		
C 11	Elect,(SR10VB-47)	47μF,±20%,10V		
C 12	Elect,(SR10VB-22)	22μF,±20%,10V		
C 13	Elect,(SR10VB-100)	100μF,±20%,10V		
C 14	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 15	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 16	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 17	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 18	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 19	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 20	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 21	Not assigned			
C 22	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 23	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 24	Not assigned			
C 25	Cer,(CK924C1H223M)	22000pF,±20%,50V		
C 26	Elect,(SR10VB-22)	22μF,±20%,10V		
C 27	Not assigned			
C 28	Cer,(CC924CH1H471J)	470pF,±5%,50V		
C 29	Cer,(CC924CH1H471J)	470pF,±5%,50V		
C 30	Not assigned			
C 31	Elect,(SM450VB-4R7)	4.7μF,±20%,450V		
C 32	Elect,(SM350VB-4R7)	4.7μF,±20%,350V		
C 33	Elect,(SR25VB-100)	100μF,±20%,25V		
C 34	Elect,(SR25VB-220)	220μF,±20%,25V		
C 35	Elect,(SR25VB-220)	220μF,±20%,25V		
C 36	Elect,(SR25VB-220)	220μF,±20%,25V		
C 37	Elect,(SR25VB-220)	220μF,±20%,25V		
C 38	Elect,(SRA25VB-22)	22μF,±20%,25V		
C 39	Elect,(SRA25VB-22)	22μF,±20%,25V		
C 40	Tant,(CS02H1D150M)	15μF,±20%,20V		
C 41	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 42	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 43	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 44	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 45	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 46	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 47	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		

( ): Manufacturer's part number
* : Selected at factory

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Parts List: CONT & APD (A5, MH951A)

CKT REF	DESCRIPTION	RATING	NOTE
C 48	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 49	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 50	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 51	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 52	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 53	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 54	Cer,(CC924CH1H102J)	1000pF,±5%,50V	
C 55	[illegible]	1000pF,±5%,50V	
F 1	Fuse, (MF51NN250V0.1ADC01)	DC250V,0.1A	
F 2	Fuse, (MF51NN250V0.1ADC01)	DC250V,0.1A	
F 3	Fuse, (MF51NN250V0.1ADC01)	DC250V,0.1A	
J 1	Plug,(DF1-15P2.5DSA)	15pins	
J 2	Plug,(DF1-8P2.5DSA)	8pins	
J 3	Socket, (HIF3FB-30DA-2.54DSA)	30pins	
J 4	Not assigned		
J 5	Not assigned		
J 6	Plug,(DF1-8P2.5DSA)	8pins	
J 7	Plug,(DF1-10P2.5DSA)	10pins	
J 8	Plug,(FFC-2AMEP)	2pins	
J 9	Not assigned		
J 10	Not assigned		
J 11	Not assigned		
J 12	Plug,(FFC-2AMEP)	2pins	
J 13	Plug,(FFC-2AMEP)	2pins	
J 14	Plug,(DF1-5P2.5DSA)	5pins	
J 15	Not assigned		
J 16	Not assigned		
J 17	Plug,(DF1-2P2.5DSA)	2pins	
J 18	Jack,(DIC-130)		
J 19	Jack,(DIC-130)		
J 20	Not assigned		
J 21	Not assigned		
J 22	Not assigned		
J 23	Plug,(FFC-3AMEP)	3pins	
J 24	Jack,(DIC-130)		
L 1	Coil,(LF8-101K)	100uH	
L 2	Coil,(LF8-101K)	100uH	

( ): Manufacturer's part number
• : Selected at factory

Parts List: CONT & APD (A5, MH951A)

CKT REF	DESCRIPTION	RATING	NOTE
M 1	Timer,(TM-0)	[illegible]	
Q 1	IC,(74HC273P)		
Q 2	IC,(74HC273P)		
Q 3	IC,(74HC366P)		
Q 4	Photo coupler, (PS2403-4)		
[illegible]	Photo coupler, (PS2403-4)		
Q 6	Photo coupler, (PS2501-4)		
Q 7	Photo coupler, (PS2403-2)		
Q 8	Photo coupler, (PS2501-2)		
Q 9	Photo coupler,(PS2007B)		
Q 10	IC,(μPC1410SH)		
Q 11	IC,(μPC1410SH)		
Q 12	IC,(LM337T)		
Q 13	Di,(1S953)		
Q 14	Not assigned		
Q 15	Not assigned		
Q 16	Photo diode,(TLR226)		
Q 17	Not assigned		
Q 18	Not assigned		
Q 19	Not assigned		
Q 20	Not assigned		
Q 21	Not assigned		
Q 22	Not assigned		
Q 23	IC,(TC74HC123AP)		
Q 24	Di,(1S953)		
Q 25	Di,(1S953)		
Q 26	Not assigned		
Q 27	Not assigned		
Q 28	Not assigned		
Q 29	Not assigned		
Q 30	Not assigned		
Q 31	Rectifier,(M4E-1)		
Q 32	Tr,(2SC505)		
Q 33	IC,(μPC258C)		
Q 34	IC,(μPC258C)		
Q 35	Di,(1S953)		
Q 36	Di,(1S953)		
Q 37	Di,(1S953)		
Q 38	Di,(1S953)		
Q 39	Di,breakdown,(1SZ52)	5.9 to 6.5V,250mW	

( ): Manufacturer's part number
• : Selected at factory

Parts List: CONT & APD (A5, MH951A)

CKT REF	DESCRIPTION	RATING	NOTE
R 1	SIL type,(RRS-8-102JA)	1kΩ x 8,±5%,1/8W	
R 2	Not assigned		
R 3	SIL type,(RRS-8-472JA)	4.7kΩ x 8,±5%,1/8W	
R 4	SIL type,(RRS-6-103JA)	10kΩ x 6,±5%,1/8W	
R 5	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 6	CF,(ARD25T511J)	510Ω,±5%,1/4W	
R 7	CF,(ARD25T511J)	510Ω,±5%,1/4W	
R 8	CF,(ARD25T221J)	220Ω,±5%,1/4W	
R 9	CF,(ARD25T221J)	220Ω,±5%,1/4W	
R 10	CF,(ARD25T221J)	220Ω,±5%,1/4W	
R 11	CF,(ARD25T221J)	220Ω,±5%,1/4W	
R 12	CF,(ARD25T821J)	820Ω,±5%,1/4W	
R 13	CF,(ARD25T821J)	820Ω,±5%,1/4W	
R 14	CF,(ARD25T102J)	1kΩ,±5%,1/4W	
R 15	CF,(ARD25T561J)	560Ω,±5%,1/4W	
R 16	CF,(ARD25T561J)	560Ω,±5%,1/4W	
R 17	CF,(ARD25T331J)	330Ω,±5%,1/4W	
R 18	MF,(RN14K2E9091D)	9.09kΩ,±0.5%,1/4W	
R 19	CF,(ARD25T105J)	1.0MΩ,±5%,1/4W	
R 20	MF,(RN14K2E1001D)	1.00kΩ,±0.5%,1/4W	
R 21	CF,(ARD25T682J)	6.8kΩ,±5%,1/4W	
R 22	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 23	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 24	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 25	Not assigned		
R 26	Not assigned		
R 27	SIL type,(RRS-8-104JA)	100kΩ x 8,±5%,1/8W	
R 28	CF,(ARD25T104J)	100kΩ,±5%,1/4W	
R 29	CF,(ARD25T104J)	100kΩ,±5%,1/4W	
R 30	Not assigned		
R 31	CF,(ARD25T472J)	4.7kΩ,±5%,1/4W	
R 32	CF,(ARD25T472J)	4.7kΩ,±5%,1/4W	
R 33	CF,(ARD25T104J)	100kΩ,±5%,1/4W	
R 34	CF,(ARD25T121J)	120Ω,±5%,1/4W	
R 35	CF,(ARD25T102J)	1.0kΩ,±5%,1/4W	
R 36	CF,(ARD25T224J)	220kΩ,±5%,1/4W	
R 37	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 38	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 39	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 40	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 41	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 42	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 43	CF,(ARD25T153J)	15kΩ,±5%,1/4W	
R 44	MF,(ARD25T224J)	220kΩ,±0.5%,1/4W	
R 45	Var,MF,(RJ-6S 500KΩ)	500kΩ,1/2W	
R 46	Var,MF,(RJ-6S 20KΩ)	20kΩ,1/2W	
R 47	Var,MF,(RJ-6S 50kΩ)	50kΩ,1/2W	

( ): Manufacturer's part number
• : Selected at factory

Parts List: CONT & APD (A5, MH951A)

CKT REF	DESCRIPTION	RATING	NOTE
R 48	MF,(RN14K2E7500D)	750Ω,±0.5%,1/4W	
R 49	CF,(ARD25T104J)	100kΩ,±5%,1/4W	
R 50	CF,(ARD25T224J)	220kΩ,±5%,1/4W	
R 51	CF,(ARD25T823J)	82kΩ,±5%,1/4W	
R 52	MF,(RN14K2E3322D)	33.2kΩ,±0.5%,1/4W	
R 53	MF,(RN14K2E4992D)	49.9kΩ,±0.5%,1/4W	
R 54	CF,(ARD25T473J)	47kΩ,±5%,1/4W	

( ): Manufacturer's part number
• : Selected at factory

Parts List: CONT & APD (A5, MH952A) 6

CKT REF	DESCRIPTION	RATING	NOTE
C 1	Elect,(SRE10VB-10)	10μF,±20%,10V	
C 2	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V	
C 3	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 4	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V	
C 5	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V	
C 6	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V	
C 7	Elect,(SR16VB-1000)	1000μF,±20%,16V	
C 8	Elect,(SR16VB-1000)	1000μF,±20%,16V	
C 9	Elect,(SR25VB-47)	47μF,±20%,25V	
C 10	Elect,(SR10VB-47)	47μF,±20%,10V	
C 11	Elect,(SR10VB-47)	47μF,±20%,10V	
C 12	Elect,(SR10VB-22)	22μF,±20%,10V	
C 13	Elect,(SR10VB-100)	100μF,±20%,10V	
C 14	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 15	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 16	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 17	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 18	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 19	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 20	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 21	Not assigned		
C 22	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 23	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 24	Not assigned		
C 25	Cer,(CK924C1H223M)	22000pF,±20%,50V	
C 26	Elect,(SR10VB-22)	22μF,±20%,10V	
C 27	Not assigned		
C 28	Cer,(CC924CH1H471J)	470pF,±5%,50V	
C 29	Cer,(CC924CH1H471J)	470pF,±5%,50V	
C 30	Not assigned		
C 31	Elect,(SXE80VB-33)	33μF,±20%,80V	8φ x 11.5L
C 32	Elect,(SME50VB-100)	100μF,±20%,50V	
C 33	Elect,(SR25VB-100)	100μF,±20%,25V	
C 34	Elect,(SR25VB-220)	220μF,±20%,25V	
C 35	Elect,(SR25VB-220)	220μF,±20%,25V	
C 36	Elect,(SR25VB-220)	220μF,±20%,25V	
C 37	Elect,(SR25VB-220)	220μF,±20%,25V	
C 38	Elect,(SRA25VB-22)	22μF,±20%,25V	
C 39	Elect,(SRA25VB-22)	22μF,±20%,25V	
C 40	Tant,(CS02H1D150M)	15μF,±20%,20V	
C 41	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V	
C 42	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V	
C 43	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V	
C 44	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V	
C 45	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V	
C 46	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 47	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	

( ): Manufacturer's part number
* : Selected at factory

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Parts List: CONT & APD (A5, MH952A)

CKT REF	DESCRIPTION	RATING	NOTE
C 48	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 49	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 50	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 51	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 52	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 53	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V	
C 54	Cer,(CC924CH1H102J)	1000pF,±5%,50V	
C 55	Cer,(CC924CH1H102J)	1000pF,±5%,50V	
F 1	Fuse, (MF51NN250V0.1ADC01)	DC250V,0.1A	
F 2	Fuse, (MF51NN250V0.1ADC01)	DC250V,0.1A	
F 3	Fuse, (MF51NN250V0.1ADC01)	DC250V,0.1A	
J 1	Plug,(DF1-15P2.5DSA)	15pins	
J 2	Plug,(DF1-8P2.5DSA)	8pins	
J 3	Socket, (H1F3FB-30DA-2.54DSA)	30pins	
J 4	Not assigned		
J 5	Not assigned		
J 6	Plug,(DF1-8P2.5DSA)	8pins	
J 7	Plug,(DF1-10P2.5DSA)	10pins	
J 8	Not assigned		
J 9	Plug,(FFC-2AMEP)	2pins	
J 10	Not assigned		
J 11	Not assigned		
J 12	Plug,(FFC-2AMEP)	2pins	
J 13	Plug,(FFC-2AMEP)	2pins	
J 14	Plug,(DF1-5P2.5DSA)	5pins	
J 15	Not assigned		
J 16	Not assigned		
J 17	Plug,(DF1-2P2.5DSA)	2pins	
J 18	Jack,(DIC-130)		
J 19	Jack,(DIC-130)		
J 20	Not assigned		
J 21	Not assigned		
J 22	Not assigned		
J 23	Plug,(FFC-3AMEP)	3pins	
J 24	Jack,(DIC-130)		
L 1	Coil,(LF8-101K)	100μH	
L 2	Coil,(LF8-101K)	100μH	

( ): Manufacturer's part number
* : Selected at factory

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Parts List: CONT & APD (A5, MH952A)

CKT REF	DESCRIPTION	RATING	NOTE
M 1	Timer,(TM-O)	5000H	
Q 1	IC,(74HC273P)		
Q 2	IC,(74HC273P)		
Q 3	IC,(74HC366P)		
Q 4	Photo coupler, (PS2403-4)		
Q 5	Photo coupler, (PS2501-4)		
Q 6	Photo coupler, (PS2401-4)		
Q 7	Photo coupler, (PS2403-2)		
Q 8	Photo coupler, (PS2501-2)		
Q 9	Photo coupler,(PS2007B)		
Q 10	IC,(μPC1430H)		
Q 11	IC,(μPC1630H)		
Q 12	IC,(LM337T)		
Q 13	Di,(1S953)		
Q 14	Not assigned		
Q 15	Not assigned		
Q 16	LED,(TLR226)		
Q 17	Not assigned		
Q 18	Not assigned		
Q 19	Not assigned		
Q 20	Not assigned		
Q 21	Not assigned		
Q 22	Not assigned		
Q 23	IC,(TC74HC123AP)		
Q 24	Di,(1S953)		
Q 25	Di,(1S953)		
Q 26	Not assigned		
Q 27	Not assigned		
Q 28	Not assigned		
Q 29	Not assigned		
Q 30	Not assigned		
Q 31	Rectifier,(M4E-1)		
Q 32	Tr,(2SC505)		
Q 33	IC,(μPC258C)		
Q 34	IC,(μPC258C)		
Q 35	Di,(1S953)		
Q 36	Di,(1S953)		
Q 37	Di,(1S953)		
Q 38	Di,(1S953)		
Q 39	Di,breakdown,(1SZ52)	5.9 to 6.5V,250mW	

( ): Manufacturer's part number
* : Selected at factory

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Parts List: CONT & APD (A5, MH952A)

CKT REF	DESCRIPTION	RATING	NOTE
R 1	SIL type,(RRS-8-102JA)	1kΩ x 8,±5%,1/8W	
R 2	Not assigned		
R 3	SIL type,(RRS-8-472JA)	4.7kΩ x 8,±5%,1/8W	
R 4	SIL type,(RRS-6-103JA)	10kΩ x 6,±5%,1/8W	
R 5	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 6	CF,(ARD25T511J)	510Ω,±5%,1/4W	
R 7	CF,(ARD25T511J)	510Ω,±5%,1/4W	
R 8	CF,(ARD25T221J)	220Ω,±5%,1/4W	
R 9	CF,(ARD25T221J)	220Ω,±5%,1/4W	
R 10	CF,(ARD25T221J)	220Ω,±5%,1/4W	
R 11	CF,(ARD25T221J)	220Ω,±5%,1/4W	
R 12	CF,(ARD25T821J)	820Ω,±5%,1/4W	
R 13	CF,(ARD25T821J)	820Ω,±5%,1/4W	
R 14	CF,(ARD25T102J)	1kΩ,±5%,1/4W	
R 15	CF,(ARD25T561J)	560Ω,±5%,1/4W	
R 16	CF,(ARD25T561J)	560Ω,±5%,1/4W	
R 17	CF,(ARD25T331J)	330Ω,±5%,1/4W	
R 18	MF,(RN14K2E9091D)	9.09kΩ,±0.5%,1/4W	
R 19	CF,(ARD25T105J)	1.0MΩ,±5%,1/4W	
R 20	MF,(RN14K2E1001D)	1.00kΩ,±0.5%,1/4W	
R 21	CF,(ARD25T682J)	6.8kΩ,±5%,1/4W	
R 22	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 23	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 24	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 25	Not assigned		
R 26	Not assigned		
R 27	SIL type,(RRS-8-104JA)	100kΩ x 8,±5%,1/8W	
R 28	CF,(ARD25T104J)	100kΩ,±5%,1/4W	
R 29	CF,(ARD25T104J)	100kΩ,±5%,1/4W	
R 30	Not assigned		
R 31	CF,(ARD25T472J)	4.7kΩ,±5%,1/4W	
R 32	CF,(ARD25T472J)	4.7kΩ,±5%,1/4W	
R 33	CF,(ARD25T104J)	100kΩ,±5%,1/4W	
R 34	CF,(ARD25T121J)	120Ω,±5%,1/4W	
R 35	CF,(ARD25T102J)	1.0kΩ,±5%,1/4W	
R 36	CF,(ARD25T224J)	220kΩ,±5%,1/4W	
R 37	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 38	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 39	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 40	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 41	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 42	CF,(ARD25T103J)	10kΩ,±5%,1/4W	
R 43	CF,(ARD25T154J)	150kΩ,±5%,1/4W	
R 44	CF,(ARD25T154J)	150kΩ,±5%,1/4W	
R 45	Var,MF,(RJ-6S 500KΩ)	500kΩ,1/2W	
R 46	Var,MF,(RJ-6S 20KΩ)	20kΩ,1/2W	
R 47	Var,MF,(RJ-6S 50kΩ)	50kΩ,1/2W	

( ): Manufacturer's part number
* : Selected at factory

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Parts List: CONT & APD (A5, MH952A)

CKT REF	DESCRIPTION	RATING		NOTE
R 48	MF,(RN14K2E7500D)	750Ω,±0.5%,1/4W		
R 49	CF,(ARD25T104J)	100kΩ,±5%,1/4W		
R 50	CF,(ARD25T224J)	220kΩ,±5%,1/4W		
R 51	CF,(ARD25T823J)	82kΩ,±5%,1/4W		
R 52	MF,(RN14K2E3322D)	33.2kΩ,±0.5%,1/4W		
R 53	MF,(RN14K2E4992D)	49.9kΩ,±0.5%,1/4W		
R 54	CF,(ARD25T473J)	47kΩ,±5%,1/4W		

( ): Manufacturer's part number
• : Selected at factory

Parts List: CONT & APD (A5, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
C 1	Elect,(SRE10VB-10)	10μF,±20%,10V		
C 2	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 3	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 4	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V		
C 5	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V		
C 6	Cer,(DSS310-55D223S)	0.022μF,+50/-20%,50V		
C 7	Elect,(SR16VB-330)	330μF,±20%,16V		
C 8	Elect,(SR16VB-330)	330μF,±20%,16V		
C 9	Elect,(SR25VB-47)	47μF,±20%,25V		
C 10	Elect,(SR10VB-47)	47μF,±20%,10V		
C 11	Elect,(SR10VB-47)	47μF,±20%,10V		
C 12	Elect,(SR10VB-22)	22μF,±20%,10V		
C 13	Elect,(SR10VB-100)	100μF,±20%,10V		
C 14	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 15	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 16	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 17	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 18	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 19	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 20	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 21	Not assigned			
C 22	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 23	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 24	Not assigned			
C 25	Cer,(CK924C1H223M)	22000pF,±20%,50V		
C 26	Elect,(SR10VB-22)	22μF,±20%,10V		
C 27	Not assigned			
C 28	Cer,(CC924CH1H471J)	470pF,±5%,50V		
C 29	Cer,(CC924CH1H471J)	470pF,±5%,50V		
C 30	Not assigned			
C 31	Elect,(SME250VB-4.7)	4.7μF,±20%,250V		8φ x 11.5L
C 32	Elect,(SME250VB-4.7)	4.7μF,±20%,250V		
C 33	Elect,(SR25VB-100)	100μF,±20%,25V		
C 34	Elect,(SR25VB-220)	220μF,±20%,25V		
C 35	Elect,(SR25VB-220)	220μF,±20%,25V		
C 36	Elect,(SR25VB-220)	220μF,±20%,25V		
C 37	Elect,(SR25VB-220)	220μF,±20%,25V		
C 38	Elect,(SRA25VB-22)	22μF,±20%,25V		
C 39	Elect,(SRA25VB-22)	22μF,±20%,25V		
C 40	Tant,(CS02H1D150M)	15μF,±20%,20V		
C 41	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 42	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 43	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 44	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 45	Cer,(RPE113F105Z50)	1μF,+80/-20%,50V		
C 46	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 47	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		

( ): Manufacturer's part number
• : Selected at factory

Parts List: CONT & APD (A5, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
C 48	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 49	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 50	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 51	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 52	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 53	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 54	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 55	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
F 1	Fuse, (MF51NN250V0.1ADC01)	DC250V,0.1A		
F 2	Fuse, (MF51NN250V0.1ADC01)	DC250V,0.1A		
F 3	Fuse, (MF51NN250V0.1ADC01)	DC250V,0.1A		
J 1	Plug,(DF1-15P2.5DSA)	15pins		
J 2	Plug,(DF1-8P2.5DSA)	8pins		
J 3	Socket, (HIF3FB-30DA-2.54DSA)	30pins		
J 4	Not assigned			
J 5	Not assigned			
J 6	Plug,(DF1-8P2.5DSA)	8pins		
J 7	Plug,(DF1-10P2.5DSA)	10pins		
J 8	Plug,(FFC-2AMEP)	2pins		
J 9	Plug,(FFC-2AMEP)	2pins		
J 10	Plug,(FFC-2AMEP)	2pins		
J 11	Not assigned			
J 12	Plug,(FFC-2AMEP)	2pins		
J 13	Plug,(FFC-2AMEP)	2pins		
J 14	Plug,(DF1-5P2.5DSA)	5pins		
J 15	Not assigned			
J 16	Not assigned			
J 17	Plug,(DF1-2P2.5DSA)	2pins		
J 18	Jack,(DIC-130)			
J 19	Jack,(DIC-130)			
J 20	Jack,(DIC-130)			MH958A only
J 21	Not assigned			
J 22	Not assigned			
J 23	Plug,(FFC-3AMEP)	3pins		
J 24	Jack,(DIC-130)			
L 1	Coil,(LF8-101K)	100μH		
L 2	Coil,(LF8-101K)	100μH		

( ): Manufacturer's part number
• : Selected at factory

Parts List: CONT & APD (A5, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
M 1	Timer,(TM-O)	5000H		
Q 1	IC,(74HC273P)			
Q 2	IC,(74HC273P)			
Q 3	IC,(74HC366P)			
Q 4	Photo coupler, (PS2403-4)			
Q 5	Photo coupler, (PS2403-4)			
Q 6	Photo coupler, (PS2501-4)			
Q 7	Photo coupler, (PS2403-2)			
Q 8	Photo coupler, (PS2501-2)			
Q 9	Photo coupler,(PS2007B)			
Q 10	IC,(μPC1430SH)			
Q 11	IC,(μPC1630SH)			
Q 12	IC,(LM337T)			
Q 13	Di,(1S953)			
Q 14	Not assigned			
Q 15	Not assigned			
Q 16	LED,(TLR226)			
Q 17	Not assigned			
Q 18	Not assigned			
Q 19	Not assigned			
Q 20	Not assigned			
Q 21	Not assigned			
Q 22	Not assigned			
Q 23	IC,(TC74HC123AP)			
Q 24	Di,(1S953)			
Q 25	Di,(1S953)			
Q 26	Not assigned			
Q 27	Not assigned			
Q 28	Not assigned			
Q 29	Not assigned			
Q 30	Not assigned			
Q 31	Rectifier,(M4E-1)			
Q 32	Tr,(2SC505)			
Q 33	IC,(μPC258C)			
Q 34	IC,(μPC258C)			
Q 35	Di,(1S953)			
Q 36	Di,(1S953)			
Q 37	Di,(1S953)			
Q 38	Di,(1S953)			
Q 39	Di,breakdown,(1SZ52)	5.9 to 6.5V, 250mW		

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( ): Manufacturer's part number
• : Selected at factory

Parts List: CONT & APD (A5, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
R 1	SIL type,(RRS-8-102JA)	1kΩ x 8,±5%,1/8W		
R 2	Not assigned			
R 3	SIL type,(RRS-8-472JA)	4.7kΩ x 8,±5%,1/8W		
R 4	SIL type,(RRS-6-103JA)	10kΩ x 6,±5%,1/8W		
R 5	CF,(ARD25T103J)	10kΩ,±5%,1/4W		
R 6	CF,(ARD25T511J)	510Ω,±5%,1/4W		
R 7	CF,(ARD25T511J)	510Ω,±5%,1/4W		
R 8	CF,(ARD25T221J)	220Ω,±5%,1/4W		
R 9	CF,(ARD25T221J)	220Ω,±5%,1/4W		
R 10	CF,(ARD25T221J)	220Ω,±5%,1/4W		
R 11	CF,(ARD25T221J)	220Ω,±5%,1/4W		
R 12	CF,(ARD25T821J)	820Ω,±5%,1/4W		
R 13	CF,(ARD25T821J)	820Ω,±5%,1/4W		
R 14	CF,(ARD25T102J)	1kΩ,±5%,1/4W		
R 15	CF,(ARD25T561J)	560Ω,±5%,1/4W		
R 16	CF,(ARD25T561J)	560Ω,±5%,1/4W		
R 17	CF,(ARD25T331J)	330Ω,±5%,1/4W		
R 18	MF,(RN14K2E9091D)	9.09kΩ,±0.5%,1/4W		
R 19	CF,(ARD25T105J)	1.0MΩ,±5%,1/4W		
R 20	MF,(RN14K2E1001D)	1.00kΩ,±0.5%,1/4W		
R 21	CF,(ARD25T682J)	6.8kΩ,±5%,1/4W		
R 22	CF,(ARD25T103J)	10kΩ,±5%,1/4W		
R 23	CF,(ARD25T103J)	10kΩ,±5%,1/4W		
R 24	CF,(ARD25T103J)	10kΩ,±5%,1/4W		
R 25	Not assigned			
R 26	Not assigned			
R 27	SIL type,(RRS-8-104JA)	100kΩ x 8,±5%,1/8W		
R 28	CF,(ARD25T104J)	100kΩ,±5%,1/4W		
R 29	CF,(ARD25T104J)	100kΩ,±5%,1/4W		
R 30	Not assigned			
R 31	CF,(ARD25T472J)	4.7kΩ,±5%,1/4W		
R 32	CF,(ARD25T472J)	4.7kΩ,±5%,1/4W		
R 33	CF,(ARD25T104J)	100kΩ,±5%,1/4W		
R 34	CF,(ARD25T121J)	120Ω,±5%,1/4W		
R 35	CF,(ARD25T102J)	1.0kΩ,±5%,1/4W		
R 36	CF,(ARD25T224J)	220kΩ,±5%,1/4W		
R 37	CF,(ARD25T103J)	10kΩ,±5%,1/4W		
R 38	CF,(ARD25T103J)	10kΩ,±5%,1/4W		
R 39	CF,(ARD25T103J)	10kΩ,±5%,1/4W		
R 40	CF,(ARD25T103J)	10kΩ,±5%,1/4W		
R 41	CF,(ARD25T103J)	10kΩ,±5%,1/4W		
R 42	CF,(ARD25T103J)	10kΩ,±5%,1/4W		
R 43	MF,(RN14K2E6042D)	60.4kΩ,±0.5%,1/4W		
R 44	CF,(ARD25T154J)	150kΩ,±5%,1/4W		
R 45	Var,MF,(RJ-6S-1MΩ)	1MΩ,1/2W		

( ): Manufacturer's part number
* : Selected at factory

Parts List: CONT & APD (A5, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
R 46	Var,MF,(RJ-6S 50kΩ)	50kΩ,1/2W		
R 47	Var,MF,(RJ-6S 50kΩ)	50kΩ,1/2W		
R 48	MF,(RN14K2E7500D)	750Ω,±0.5%,1/4W		
R 49	CF,(ARD25T104J)	100kΩ,±5%,1/4W		
R 50	CF,(ARD25T224J)	220kΩ,±5%,1/4W		
R 51	CF,(ARD25T823J)	82kΩ,±5%,1/4W		
R 52	MF,(RN14K2E3322D)	33.2kΩ,±0.5%,1/4W		
R 53	MF,(RN14K2E4992D)	49.9kΩ,±0.5%,1/4W		
R 54	CF,(ARD25T473J)	47kΩ,±5%,1/4W		

( ): Manufacturer's part number
* : Selected at factory

Parts List: LD UNIT (A8, MH951A/MH952A/MH958A/MH968A) 7

CKT REF	DESCRIPTION	RATING		NOTE
A 1	LD DRIVER 1 PC board			
A 2	LD Module			

( ): Manufacturer's part number
* : Selected at factory

Parts List: LD DRIVER1 (A8-A1, MH951A/MH952A/MH958A/MH968A) 8

CKT REF	DESCRIPTION	RATING		NOTE
C 1	Cer,(CC732CH1H101J)	100pF,±5%,50V		
C 2	Cer,(CK732B1H102K)	1000pF,±10%,50V		
C 3	Cer,(CK737F1H105Z)	1μF,+80/-20%,50V		
C 4	Cer,(CK733F1H104Z)	0.1μF,+80/-20%,50V		
C 5	Elect,(SR25VB-47)	47μF,±20%,25V		
C 6	Tant,(CS734E1D156M)	15μF,±20%,20V		
C 7	Tant,(CS734E1D156M)	15μF,±20%,20V		
C 8	Elect,(SR25VB-47)	47μF,±20%,25V		
J 1	Plug,(DF1-2P2.5DSA)	2pins		
J 2	Jack,(27DP-LR-PC)			
J 3	Plug,(FFC-3AMEP)	3pins		
J 4	Jack,(DIC-130)			
L 1	Coil,(NL453232-1R0K)	1.0μH,±10%,		
Q 1	Tr,(2SC1595)			
Q 2	Tr,(2SC1595)			
Q 3	Di,(1S953)			
R 1	CM,(RM73B2B120JD)	12Ω,±5%,1/8W		
R 2	CM,(RM73B2B120JD)	12Ω,±5%,1/8W		
R 3	CM,(RM73B2B * JD)	10 to 56Ω,±5%,1/8W		*10
R 4	CM,(RM73B2B * JD)	10 to 56Ω,±5%,1/8W		*10
R 5	CM,(RM73B2B510JD)	51Ω,±5%,1/8W		
R 6	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 7	CM,(RM73B2B220JD)	22Ω,±5%,1/8W		
R 8	CM,(RM73B2B331JD)	330Ω,±5%,1/8W		
R 9	CM,(RM73B2B4R7JD)	4.7Ω,±5%,1/8W		
R 10	CM,(RM73B2B100JD)	10Ω,±5%,1/8W		

( ): Manufacturer's part number
* : Selected at factory

Parts List: AO TIMING (A6, MH958A/MH968A) 9

CKT REF	DESCRIPTION	RATING		NOTE
C 1	Cer,(CC45CH1H820JY)	82pF,±5%,50V		
C 2	Cer,(CC45CH1H820JY)	82pF,±5%,50V		
C 3	Cer,(CC45CH1H820JY)	82pF,±5%,50V		
C 4	Cer,(CC45CH1H820JY)	82pF,±5%,50V		
C 5	Elect,(SR10VB-220)	220μF,±20%,10V		
C 6	Elect,(SR10VB-22)	22μF,±20%,10V		
C 7	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 8	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 9	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 10	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 11	Not assigned			
C 12	Not assigned			
C 13	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 14	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 15	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 16	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 17	Elect,(SR10VB-220)	220μF,±20%,10V		
C 18	Elect,(SR10VB-22)	22μF,±20%,10V		
C 19	Cer,(CC45CH1H820JY)	82pF,±5%,50V		
C 20	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 21	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 22	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 23	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 24	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 25	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
J 1	Plug,(DF1-3P2.5DSA)	3pins		
J 2	Not assigned			
J 3	Plug,(DF1-5P2.5DSA)	5pins		
J 4	Plug,(DF1-3P2.5DSA)	3pins		
L 1	Coil,(SP0408-1R5K)	1.5μH		
L 2	Coil,(SP0408-1R5K)	1.5μH		
Q 1	IC,(74LS14P)			
Q 2	IC,(HD74LS221P)			
Q 3	IC,(HD74LS221P)			
Q 4	IC,(74LS30P)			
Q 5	IC,(74LS221P)			
Q 6	Not assigned			
Q 7	Not assigned			
Q 8	Not assigned			

( ): Manufacturer's part number
* : Selected at factory

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Parts List: AO TIMING (A6, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
R 1	Var,MF,(RJ-6P 20kΩ)	20kΩ,1/2W		
R 2	Var,MF,(RJ-6P 5 to 20kΩ)	5kΩ,1/2W		
R 3	MF,(RN14K2E4991D)	4.99kΩ,±0.5%,1/4W		
R 4	CF,(ARD25T502-183J)	5 to 18kΩ,±5%,1/4W		
R 5	Var,MF,(RJ-6P 10kΩ)	10kW,1/2W		
R 6	Var,MF,(RJ-6P 10KΩ)	10kΩ,1/2W		
R 7	CF,(ARD25T222J)	2.2kΩ,±5%,1/4W		
R 8	CF,(ARD25T222J)	2.2kΩ,±5%,1/4W		
R 9	SIL type,(RRS-6-104JA)	100kΩ x 6,±5%,1/8W		
R 10	Var,MF,(RJ-6P 50KΩ)	50kΩ,1/2W		
R 11	MF,(RN14K2E1821D)	1.82kΩ,±0.5%,1/4W		
R 12	CF,(ARD25T472J)	4.7kΩ,±5%,1/4W		
R 13	CF,(ARD25T472J)	4.7kΩ,±5%,1/4W		
R 14	CF,(ARD25T472J)	4.7kΩ,±5%,1/4W		

( ): Manufacturer's part number
* : Selected at factory

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Parts List: AO DRIVER (A7, MH958A/MH968A) 10

CKT REF	DESCRIPTION	RATING		NOTE
C 1	Elect,(KME35VB47)	47μF,±20%,35V		
C 2	Elect,(KME16VB47)	47μF,±20%,16V		
C 3	Elect,(KME16VB47)	47μF,±20%,16V		
C 4	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 5	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 6	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 7	Not assigned			
C 8	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 9	Cer,(CK924F1H104Z)	0.1μF,+80/-20%,50V		
C 10	Elect,(CE04C1V221)	220μF,±20%,35V		
C 11	Elect,(CE04C1V221)	220μF,±20%,35V		
C 12	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 13	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 14	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 15	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
C 16	Cer,(CC924CH1H102J)	1000pF,±5%,50V		
J 1	Plug,(DF1-5P2.5DSA)	5pins		
J 2	Jack,(HRM300-126S)			
L 1	Coil,(SP0408-1R5K)	1.5μH,±10%		
Q 1	Photo coupler,(PS2007B)			
Q 2	Not assigned			
Q 3	IC,(μPC14305H)			
Q 4	Di,(1S953)			
Q 5	Di,breakdown,(RD9.1E)	8.29 to 9.3V,400mW		
Q 6	IC,(MC-5156)			
Q 7	IC,(MC-5822)			
Q 8	Tr,(2SA1206)			
R 1	CF,(ARD25T681J)	680Ω,±5%,1/4W		
R 2	CF,(ARD25T221J)	220Ω,±5%,1/4W		
R 3	CF,(ARD25T151J)	150Ω,±5%,1/4W		
R 4	Var,MF,(RJ-6S 100Ω)	100Ω,1/2W		
R 5	CF,(ARD25T821J)	820Ω,±5%,1/4W		
R 6	CF,(ARD25T510J)	51Ω,±5%,1/4W		
R 7	MF,(RS1FB220ΩJ)	220Ω,±5%,1W		
R 8	CF,(ARD25T470J)	47Ω,±5%,1/4W		
R 9	CF,(ARD25T221J)	220Ω,±5%,1/4W		

( ): Manufacturer's part number
* : Selected at factory

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Parts List: AO DRIVER (A7, MH958A/MH968A)

CKT REF	DESCRIPTION	RATING		NOTE
Z 1	XTAL OSC, (TCO-313B(120MHZ))	120MHz		
Z 2	Mixer,(M-4)			

( ): Manufacturer's part number
* : Selected at factory

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